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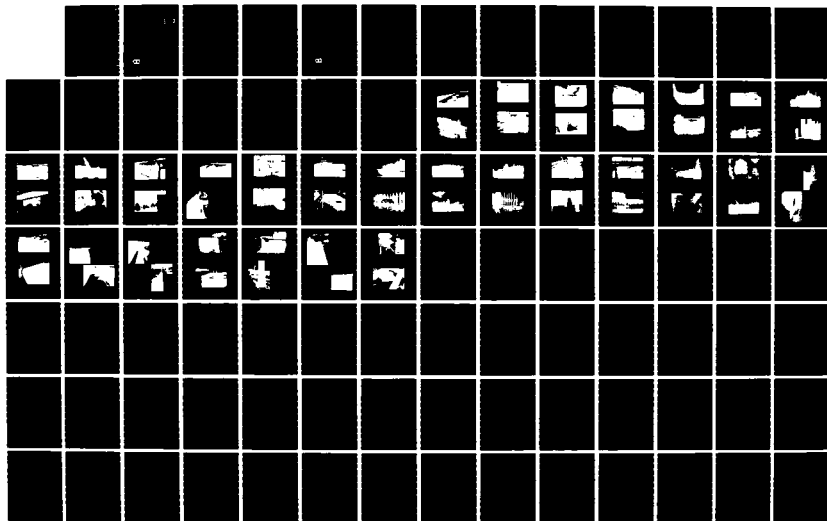
POL PIER REPAIRS LAJES FIELD AZORES(U) OLKO ENGINEERING  
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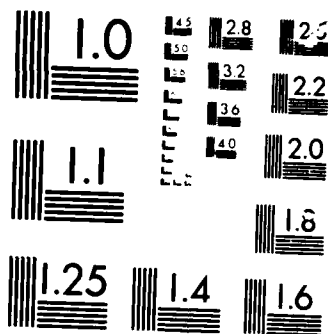
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U.S. NAVY DESIGN CONTRACT  
N-62477-79-C-0021 (MOD. P-00003)

U.S. ARMY CONSTRUCTION CONTRACT  
DACA 51-79-C-0123

AD-A169 015

POL PIER REPAIRS  
LAJES FIELD , AZORES

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FINAL FIELD INSPECTION REPORT  
FEBRUARY 1983

DIRECTED BY

DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING COMMAND

CHESAPEAKE DIVISION  
WASHINGTON , D.C.

BY



OLKO ENGINEERING  
CONSULTANTS • DESIGNERS

15 WEST 36 STREET

NEW YORK, N. Y. 10018

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The Petroleum-Oil-Lubricant (POL) Pier at Lajes Field is on the island of  
Terceira, in the Azores, located in the Atlantic Ocean, about 1,000 miles west  
of Portugal. The facility was constructed in the early 1960's for unloading  
of oil tankers, plus general cargo transfer operations. The pier is (Con't)  
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used by both the U.S. Government, servicing the U.S. Air Force Base at Lajes Field, and is used also by the Portugese Government.

The original POL Pier consisted of a breakwater protected tanker berth, served by a central loading platform (200 ft. x 40 ft.), plus four mooring dolphins, with connecting roadways (inshore) and connecting catwalks (offshore).

The Pier was originally designed to accommodate T-2 Class tankers (20,000 displacement tons), but larger vessels of the T-5 Class (40,000 displacement tons) were berthed with increased frequency. The greater ship length and displacement tonnages imposed difficulties in operating the POL Pier safely and economically. Consequently, the existing Pier had to be repaired, strengthened and extended to meet the new mission requirements.

Over the years, the Pier had been damaged due to the corrosive and adverse environmental conditions, plus accidental impacts from berthing vessels. The timber fendering system at the Central Loading Platform was in very poor condition and the south end of the concrete Loading Platform had been damaged, with partial separation of the deck from the supporting piles, plus cracking of the concrete deck and cap beams.

The overall scope of work was to repair the damaged concrete, provide improved fendering, and to expand the facility to accommodate T-5 tankers - strengthening the existing structures, where required, and installing new breasting dolphins (if required). Also, various improvements were required to the electrical and cathodic protection systems.

**U.S. NAVY DESIGN CONTRACT  
N-62477-79-C-0021 (MOD. P-00003)**

**U.S. ARMY CONSTRUCTION CONTRACT  
DACA 51-79-C-0123**

**POL PIER REPAIRS  
LAJES FIELD , AZORES**

**FINAL FIELD INSPECTION REPORT  
FEBRUARY 1983**

**DIRECTED BY**

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NAVAL FACILITIES ENGINEERING COMMAND**

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# INDEX

	<u>Page</u>
FINAL FIELD INSPECTION REPORT	
Project Overview . . . . .	1
Design of Repairs and New Facilities . . . . .	3
Construction Work . . . . .	7
Construction Costs . . . . .	9
As-Built Drawings . . . . .	10
Future Work . . . . .	12
PHOTOGRAPHS OF CONSTRUCTION PROGRESS	
Jan. 1979 - Before Construction . . . . .	P-1 to P-5
July 1980 - During Construction . . . . .	P-6 to P-10
Sept.-Oct. 1980 - During Construction . . . . .	P-11 to P-21
June 1981 - During Construction . . . . .	P-22 to P-28
EXCERPTS FROM CONTRACT DRAWINGS	
Portions of 9 Drawings	
CONSTRUCTION INSPECTION VISIT NO. 4	
June 4 to June 10, 1981 . . . . .	Pages 1 to 35

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POL PIER REPAIRS  
LAJES FIELD, AZORES

FINAL FIELD INSPECTION REPORT  
FEBRUARY 1983

Contract No. N-62477-79-C-0021  
Modification P-00003

The repair and rehabilitation work of the POL Pier at Lajes Field, Azores, has been completed.

The purpose of this report is to summarize the project - in terms of the original project scope, the work that was actually accomplished, the construction costs, and additional work required in the future.

Supplementing this review is a detailed account of the last (final) construction inspection visit made by Olko Engineering, from June 4 to June 10, 1981.

PROJECT OVERVIEW

The Petroleum-Oil-Lubricant (POL) Pier at Lajes Field is on the island of Terceira, in the Azores, located in the Atlantic Ocean, about 1,000 miles west of Portugal. The facility was constructed in the early 1960's for unloading of oil tankers, plus general cargo transfer operations.



The pier is used by both the U. S. Government, servicing the U. S. Air Force Base at Lajes Field, and is used also by the Portuguese Government.

The original POL Pier consisted of a breakwater protected tanker berth, served by a central loading platform (200 ft. x 40 ft.), plus four mooring dolphins, with connecting roadways (inshore) and connecting catwalks (offshore).

The Pier was originally designed to accommodate T-2 Class tankers (20,000 displacement tons), but larger vessels of the T-5 Class (40,000 displacement tons) were berthed with increased frequency. The greater ship length and displacement tonnages imposed difficulties in operating the POL Pier safely and economically. Consequently, the existing Pier had to be repaired, strengthened and extended to meet the new mission requirements.

Over the years, the Pier had been damaged due to the corrosive and adverse environmental conditions, plus accidental impacts from berthing vessels. The timber fendering system at the Central Loading Platform was in very poor condition and the south end of the concrete Loading Platform had been damaged, with partial separation of the deck from the supporting piles, plus cracking of the concrete deck and cap beams.

The overall scope of work was to repair the damaged concrete, provide improved fendering, and to expand the facility to accommodate T-5 tankers - strengthening the existing structures, where required, and installing new breasting dolphins (if required). Also, various improvements were required to the electrical and cathodic protection systems.

Photographs of the Pier and the new construction are included in the Appendix - summarizing the work at various stages of construction.

#### DESIGN OF REPAIRS AND NEW FACILITIES

The design contract was awarded to Olko Engineering on December 28, 1978, by the Chesapeake Division of the Naval Facilities Engineering Command. A site visit was then made to Lajes Field from January 6 to 19, 1979 - to collect basic data for design. The design work was completed on May 25, 1979 - with the submission of the Contract Specifications and 40 drawings.

The original scope of work, as assigned under design Contract N-62477-79-C-0021, consisted of the following:

"The repair work includes -

- a) Sealing cracked and spalled areas in the present Pier Loading Platform,

- b) Replacing damaged timber fendering,
- c) Installation of 3 cellular breasting dolphins and appurtenant fendering and catwalks and
- d) Installation of a POL manifold on the middle dolphin with pipelines connected back to the present manifold."

It was intended to proceed with the designs on the basis of this scope of work. However, after the site investigation was made and layouts of ships at berth were studied, it was concluded that a satisfactory design could be achieved with construction of only two breasting dolphins, instead of three, and eliminating the additional manifold but utilizing longer connecting hoses from the existing manifold.

Additional design recommendations made by Olko Engineering included the following:

Loading Platform - Structural analysis of the existing Loading Platform, as a breasting structure, demonstrated that it could not withstand design loads from a T-5 tanker, and that "strengthening" of the Loading Platform for this purpose was not practical. This confirmed the original expectation that new breasting dolphins would be required, to safely accommodate T-5 tankers.

Repair work to the Loading Platform required repairs of cracked platform deck and beams (due mainly to accidental ship impacts), plus "tying down" the tension batter piles, to provide an adequate structural connection between the piles and the deck structure, to fully engage the piles for uplift, under horizontal loading. Previously, some of these piles had been disengaged from the deck, due to ship impacts, and the field inspection demonstrated that embedment of the piles into the concrete pile caps must be improved.

Breasting Dolphins - It was recommended to construct two new Breasting Dolphins, alongside the existing Loading Platform ("New North Dolphin" and "New South Dolphin"). It was originally envisioned that the dolphins would be circular sheetpile cells. However, it was finally determined to design rectangular cells, with connecting tie rods - using a "bulkhead" type structure with heavier sheeting, designed for bending, in contrast to circular cells, relying on sheetpile interlock and hoop tension. The rectangular cells were selected for ease of construction - in terms of template requirements and the handling, setting, threading and driving the zee-sheeting in relatively deep water and adverse wave conditions, compared to flat web sheets in a circular cell pattern.

Fender Systems - It was recommended to utilize "Sea Cushion" type fenders at the new breasting dolphins. These units float with the tide, have low impact reaction/high energy absorption characteristics, and provide a sufficient breasting distance to avoid interference between the (rolling) vessel and the structure.

At the Loading Platform, it was determined that existing fendering arrangement, utilizing timber fender piles, was totally inadequate - considering its past performance and the increasingly severe berthing demands. It was recommended to abandon the timber system and install new "Sea Cushion" type fendering, similar to fendering at the new breasting dolphins. This required that new steel sheeting be driven, in front of and framing into the Loading Platform, to provide a face for the fendering.

Mooring Dolphins - Structural analysis indicated that mooring loads from a T-5 tanker resulted in excessive pile uplift loads at Mooring Dolphins Nos. 2, 3 and 4. To "strengthen" the mooring dolphins, it was recommended to install rock anchor tiedowns, drilled into bedrock, consisting of rebar-reinforced concrete anchorages, pressure grouted into steel pipe casings.

The detailed design and preparation of contract specifications, drawings and cost estimates proceeded on this basis.

CONSTRUCTION WORK

Invitations to bid were advertised on June 29, 1979 and bids were received from contractors on August 30, 1979. The three contractors were:

DANAC, Inc. - New Rochelle, NY .....	\$2,338,420
Compania Portuguesa Trabalhos - Azores	\$2,466,526
Atlantic Diving Corp., Inc. - Glouster, Mass. ....	\$3,217,233

In comparison, the Government estimate was \$2,234,115. This includes Government Furnished Transportation.

None of the above bids and estimate include Government furnished materials, consisting primarily of the steel sheet piling.

Construction work by DANAC, Inc. began in the Spring of 1980, and was finally completed and approved, with the submission of As-Built Drawings, in October 1982.

During the initial period of "major construction", the Pier was temporarily shut down, for a 107 day period from June 11, 1980 to September 25, 1980. A 100-day shutdown period had been originally stipulated, but was later extended to accommodate the contractor in view of certain unavoidable delays. Otherwise, apart from this 107 day period,

the Pier remained operational and tanker berthings continued as usual. The original, "official" contract completion date was October 7, 1980.

The major items of repair and new construction consisted of:

- (a) tying the existing loading platform deck down to the supporting piles;
- (b) sealing cracks and spalls in the concrete deck and cap beams;
- (c) installing two new rectangular steel sheet pile dolphins at each end of the platform;
- (d) installing new steel sheet pile fendering in front of the loading platform;
- (e) installing new rubber cushion fenders at the new rectangular dolphins, at the loading platform and at the existing dolphin No. 4;
- (f) installing tension anchorage into bed rock at the existing mooring dolphins Nos. 2, 3, and 4; and
- (g) installing impressed current cathodic protection grounding system, platform illuminations and navigation aids.

Four construction inspection visits were made by Olko Engineering on the following dates:

April 16 to 18,..... 1980

July 21 to 27, ..... 1980

Sept. 25 to Oct. 3, 1980

June 4 to 10, ..... 1981

The work was still in progress during the fourth visit in June 1981 and therefore, the final inspection and acceptance was made by personnel of NAVFAC, Norfolk, VA.

#### CONSTRUCTION COSTS

DANAC, Inc. was accepted as the low bidder at a bid price of \$2,196,600 (not including transportation or Government furnished materials).

The final construction cost, paid to DANAC, Inc., was \$2,486,963 - approximately \$290,000 above the original bid price. This added cost was due mainly to unexpected underwater obstructions and construction delays, plus various "new" items which were later added to the project scope of work.

The added costs related to items included in the original scope of work amounted to about \$164,000 - as follows:



1. Underwater boulder obstructions, encountered while installing rock anchor tiedowns, plus various miscellaneous change orders - Approx. \$91,000.
2. Removal of underwater concrete and pipe obstructions - Approx. \$17,000.
3. Construction delays (including government offloading of crane) - Approx. \$56,000.

Additional costs, attributed to "new" work, beyond the original scope of work, amounted to about \$126,000 and consisted of:

1. Renovation of warehouse - Approx. \$76,000.
2. Additional concrete repairs at Approach Roadway to the Pier - Approx. \$40,000.
3. Fabrication of fendering bracket for northwest corner of the North Breasting Dolphin - Approx. \$10,000.

#### AS-BUILT DRAWINGS

As-Built Drawings were prepared by DANAC, Inc., at the completion of work, noting modifications to the contract plans and specifications, "changed conditions", and actual penetrations of the piles, as installed. These changes were incorporated onto the tracings, by Olko Engineering, and submitted to the Government on October 20, 1982.

The As-Built Drawings reflected the following changes, compared to the original Contract Plans (Rev. A on the Drawings):

1. Additional concrete crack repairs were made to the underdeck of the Approach Roadway (Sheet 3).
2. At Mooring Dolphin No. 1 (a circular sheetpile cell), maintenance work was required for the top two feet of sheeting, underneath the concrete cap (Sheet 3). This portion of the sheeting was first sand blasted and then repainted.
3. At the Loading Platform, the concrete crack repair pattern was modified slightly (Sheet 5).
4. Concrete pipe obstructions were encountered while installing the South Dolphin, which required removal (Sheet 15).
5. As-driven sheetpile tip elevations were noted (Sheets 13, 14 and 15).
6. The corner bracket detail for the fendering was modified slightly (Sheets 18, 21 and 30).
7. A specially fabricated fender unit was installed at the northwest corner of the North Dolphin, to protect this corner from impact, during ship departures (Sheet 29).

8. At the Loading Platform, the walers for the new sheetpile fendering system were raised, from El. +9.0 to El. +10.0 (Sheets 26 and 27).
9. Two (2) bolts and plate washers were added to the base plate for the floodlight tower (Sheet 24).
10. Actual installed lengths were noted for the rock anchorages, including the depth of soil penetration and the length of the rock socket (Sheets 33 and 34).
11. Modifications were made to the electrical system, due to various changed conditions from the Contract Plans (Sheets 36 to 38).

Otherwise, apart from these rather minor changes, it is understood that all construction work conforms to the Contract Specifications and Plans, as designed.

#### FUTURE WORK

The major outstanding item is the cathodic protection system for the new construction, which has not yet been connected. The system is complete, except for the cable connecting the pier junction boxes to the cathodic protection rectifier, located onshore (Contract Plans - Sheet 39). Until the system is finally connected and balanced, there is concern that the new steel sheeting may be subject to accelerated cor-

rosion - serving as a large anode to the previous pier cathodic protection system, which is still operational. Accordingly, this work should be accomplished as soon as possible.

An additional item, recommended for future work, is to repair the deteriorated fendering system at Mooring Dolphin No. 4, for use as a tug berth, on the south side of the Dolphin.

The old lighting system and other electrical work, on the original pier structure, should be made explosion-proof, to conform with the new electrical work.

  
S. M. Olko

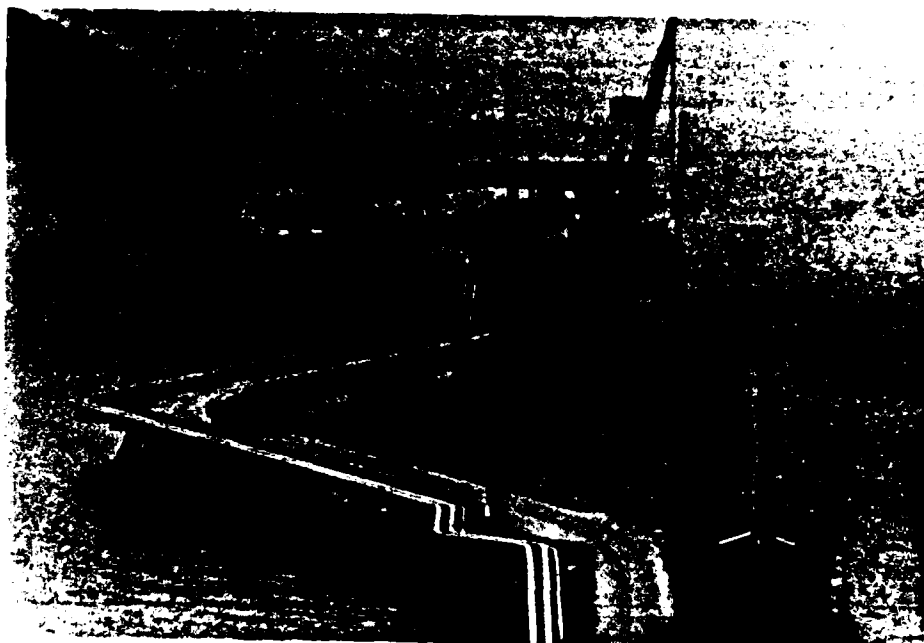
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PHOTOGRAPHS OF CONSTRUCTION PROGRESS

Photo  
No. 1



Photo  
No. 2



General views of existing POL Pier complex - Looking southward at Praia Bay, the Breakwater and the Pier facilities which consist of a Central Loading Platform, Mooring Dolphins, Roadway and Catwalks.



Photo No. 3. Looking southward at the south end of the Loading Platform. The deck slab cracks run longitudinally north-south, for a distance of about 60 feet over the batter pile frames.

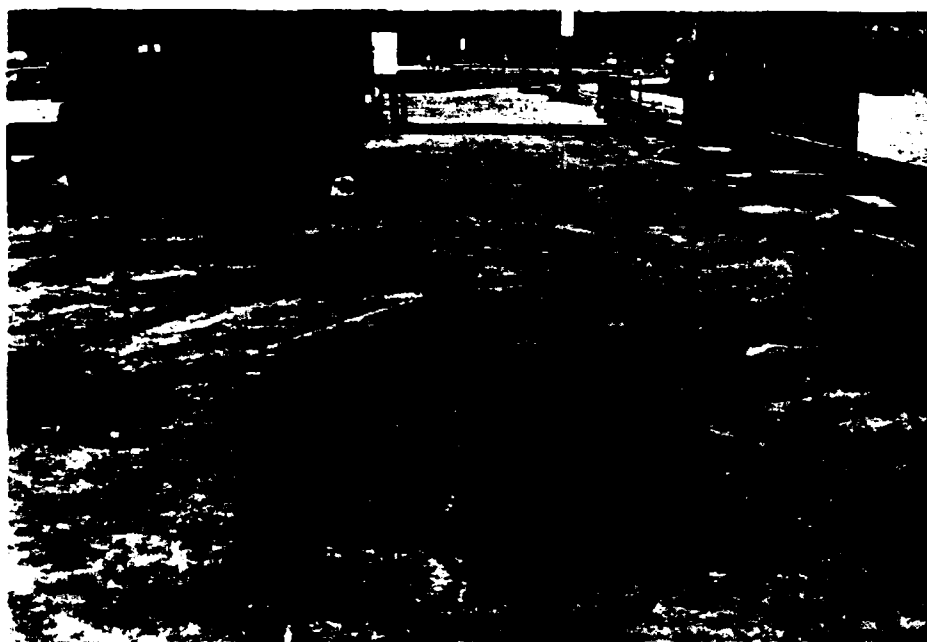


Photo No. 4. Looking northward along the Loading Platform. The 60 feet of deck slab cracks of Photo No. 3 terminate where the supporting batter pile frames terminate. There are no cracks over the central vertical pile area, nor over the north end (batter pile framed area) of the Loading Platform.

Photo  
No. 5

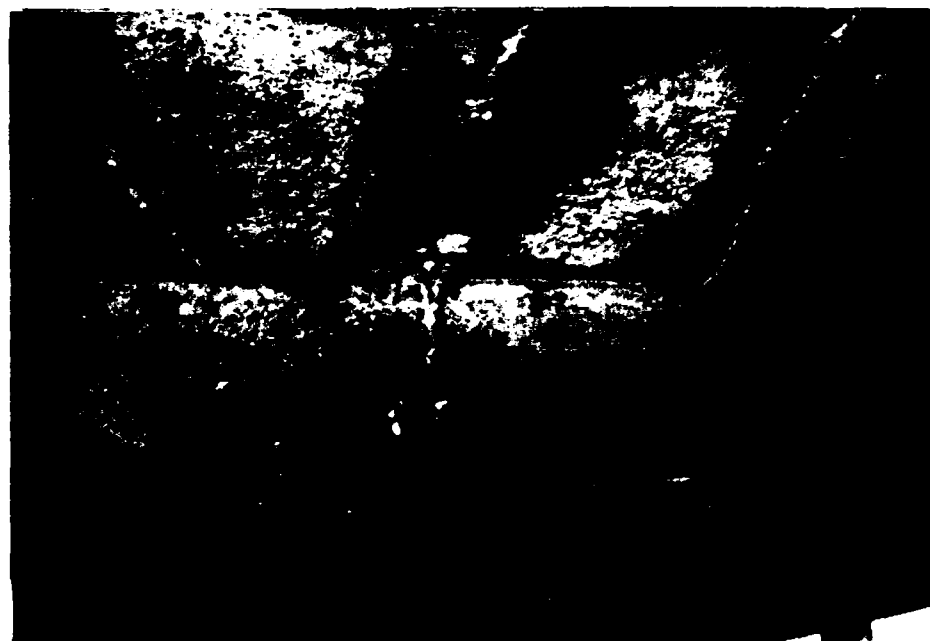


Photo  
No. 6



Typical cracks in the underside deck slabs and partial cracking of the supporting Pile Cap Beams of the Loading Platform, at the south end. These cracks are basically an extension of the top surface cracks of Photos Nos. 3 and 4, running for about 60 feet, over the batter pile frames.



Photo  
No. 7



Photo  
No. 8



Typical views of the spalled Pile Cap Beams at the junction of the outboard (west) Batter Pile, which goes into tension when a ship breasts (or impacts) against the Loading Platform. The tension pull bent down the welded reinforcement and spalled off the concrete. A "chip out" investigation at the south end bent revealed a void above the 16" diameter Pipe Pile, where the pile had pulled away from the cap beam.



Photo No. 9. Looking north at the underside of Span #1, supported by the shore abutment of the Access Roadway. The spalled concrete deck, between the steel girders, has exposed the reinforcing steel to corrosion.

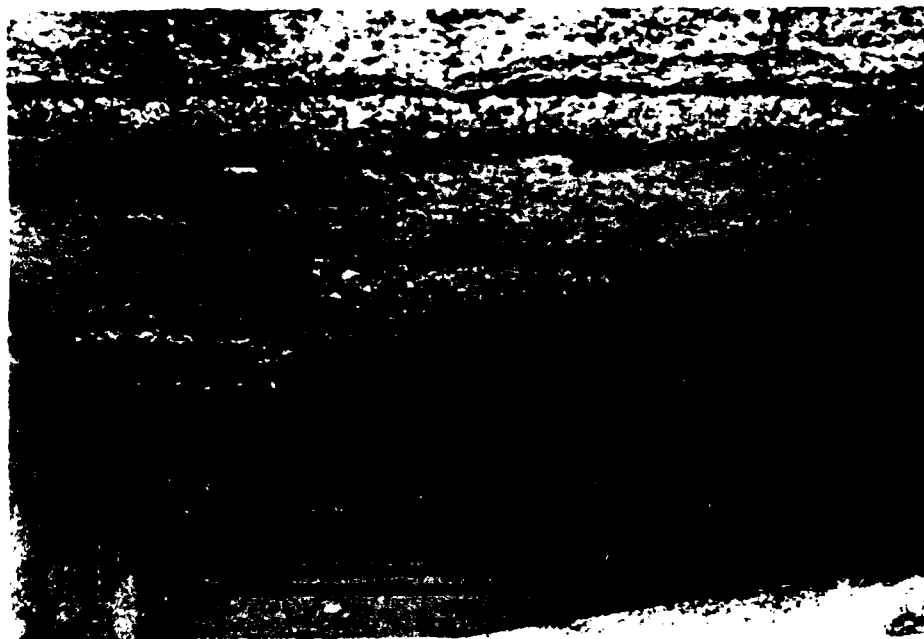
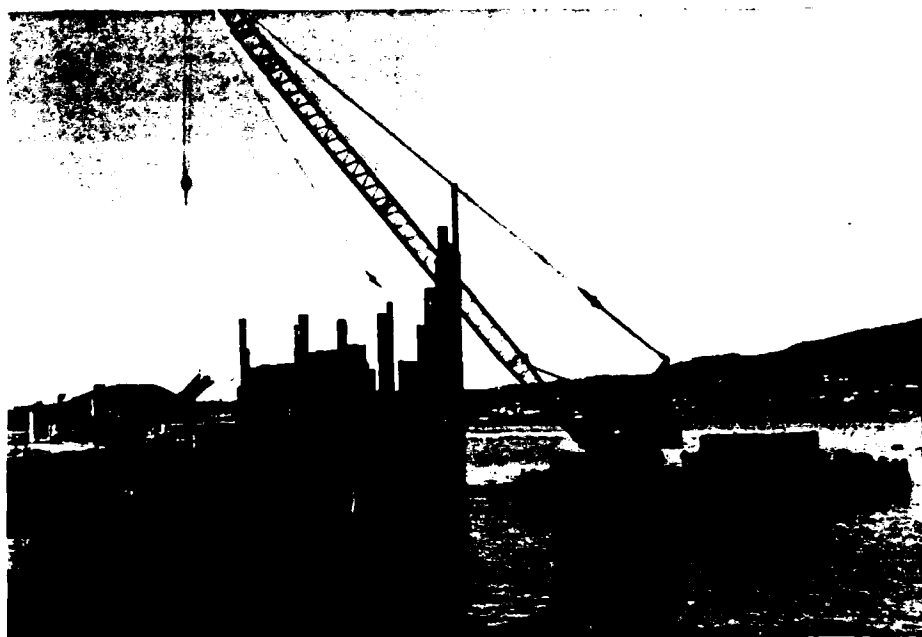


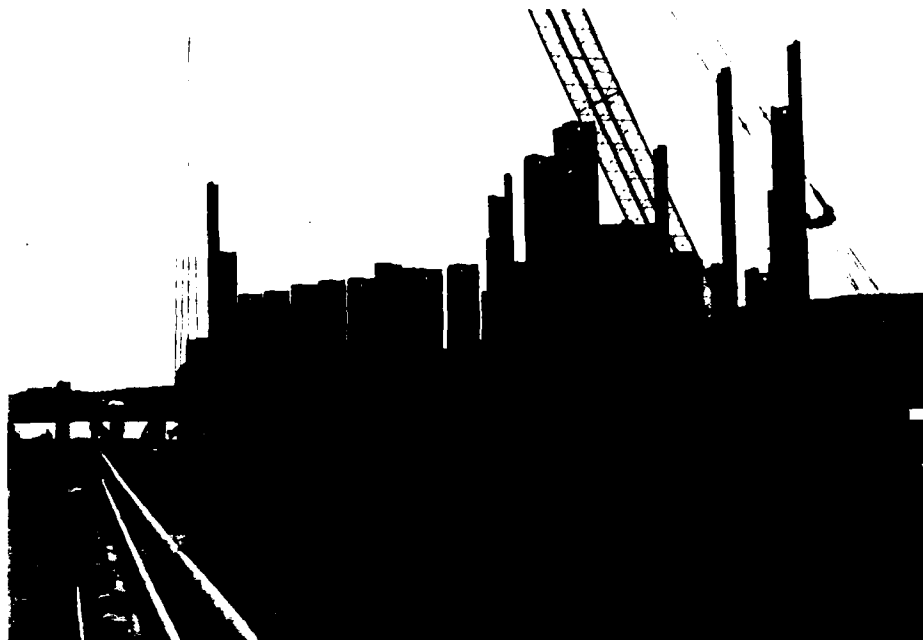
Photo No. 10. Looking north at the underside of Span #3, supported by the existing sheet pile cell Dolphin No. 1. The spalled concrete deck, between the steel girders, has exposed the reinforcing steel to corrosion.



POL PIER - OVERALL VIEW  
Barge Crane at New North Dolphin



NEW NORTH DOLPHIN  
Threading the West Wall and Driving at the Other  
Three Walls to Level the Sheet Piles



NEW NORTH DOLPHIN  
Epoxy Paint Touch Up of Abraded Sheet Piles.



NEW NORTH DOLPHIN  
Threading Sheets at the North End of the West Wall.  
The Other Three Walls Have Been Partially Driven.



#### LOADING PLATFORM

Openings in Deck for Batter Pile Tie Downs, at South End of Loading Platform.



#### LOADING PLATFORM

Angle Plates, for Batter Pile Tie Down, to be Placed Beneath Reinforcement.



DOLPHIN NO. 3 - ROCK ANCHORAGE  
Driving 10 Inch Casing for North Rock Anchorage.



DOLPHIN NO. 3 - ROCK ANCHORAGE  
Concrete Cap Opening Made by Drilling a Series of  
Rotary Bit Holes.



LOADING PLATFORM - SOUTH END  
Installing Bolts to Tie-In the Template for the New  
South Dolphin.



DOLPHIN NO. 1 - APPROACHWAY  
Corrosion of Top of Sheet Pile Cell. Spalling of  
Concrete Deck Slab.



**POL PIER - OVERALL VIEW**

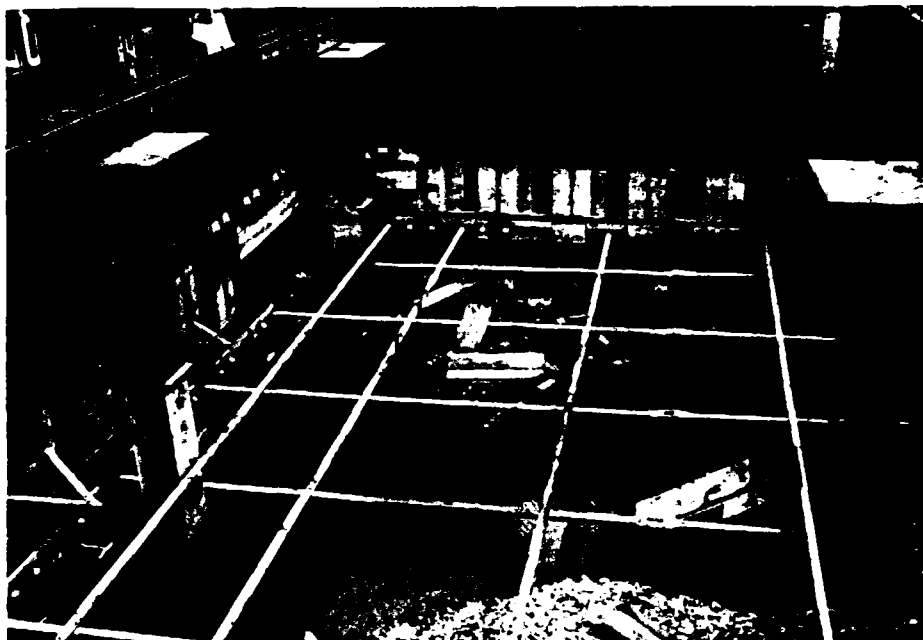
First Ship to Be Berthed - "World Promise" - After the 100-Day Shutdown Period. Unloaded 41,000 BBL of Diesel Oil



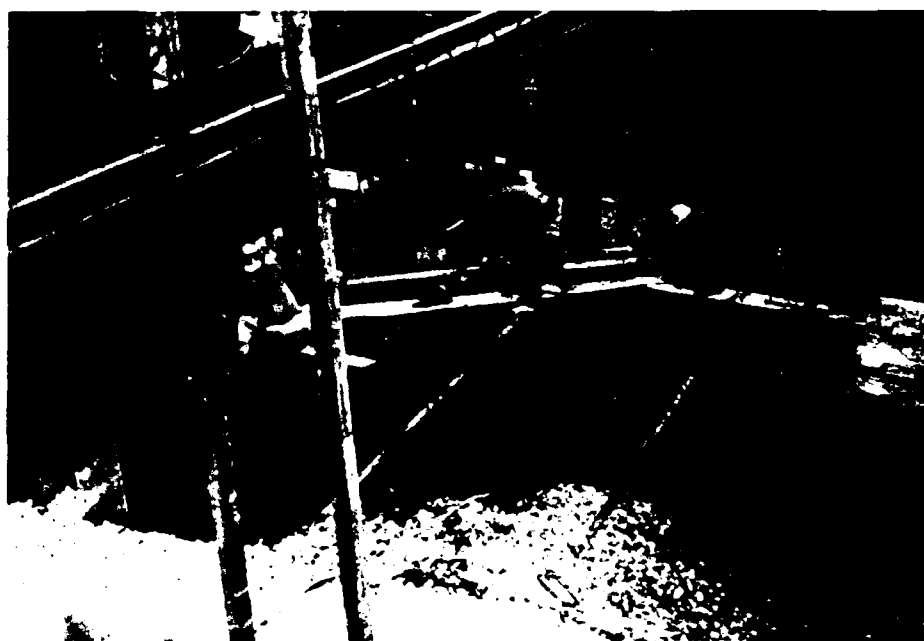
**LOADING PLATFORM**

"World Promise" At Berth, Bearing Against the New Steel Sheet Pile Fendering and "Sea Cushion" Foam Filled Floating Marine Fenders

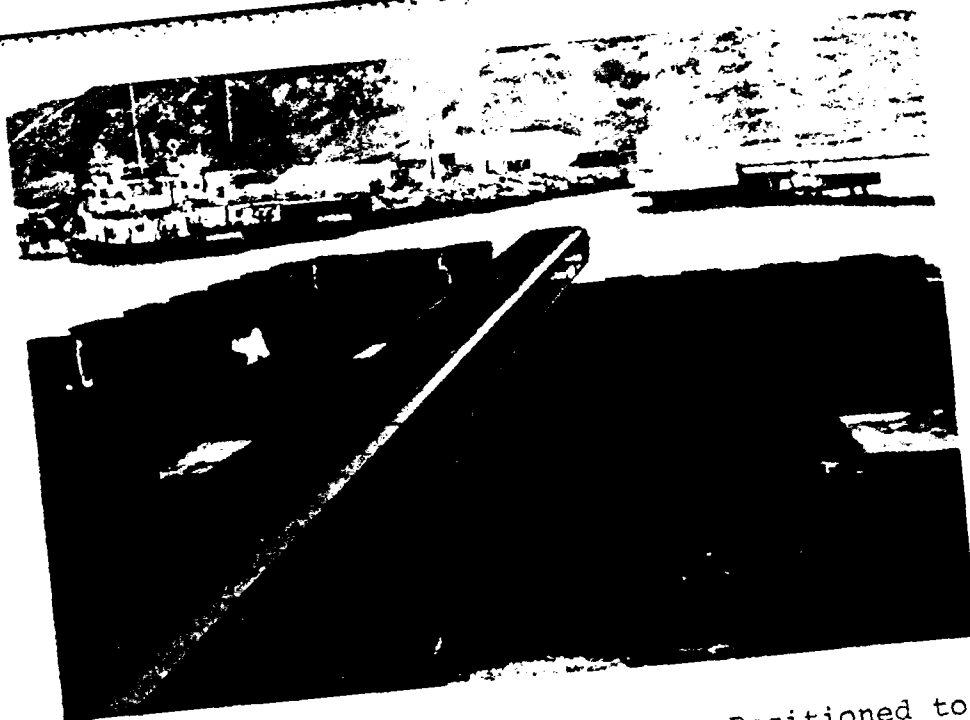




NEW NORTH DOLPHIN  
Looking North at the Internal Waler and Tie Rod System. The Cell is Partially Filled with Crushed Stone



NEW NORTH DOLPHIN  
Welding the Corner Tie Rods



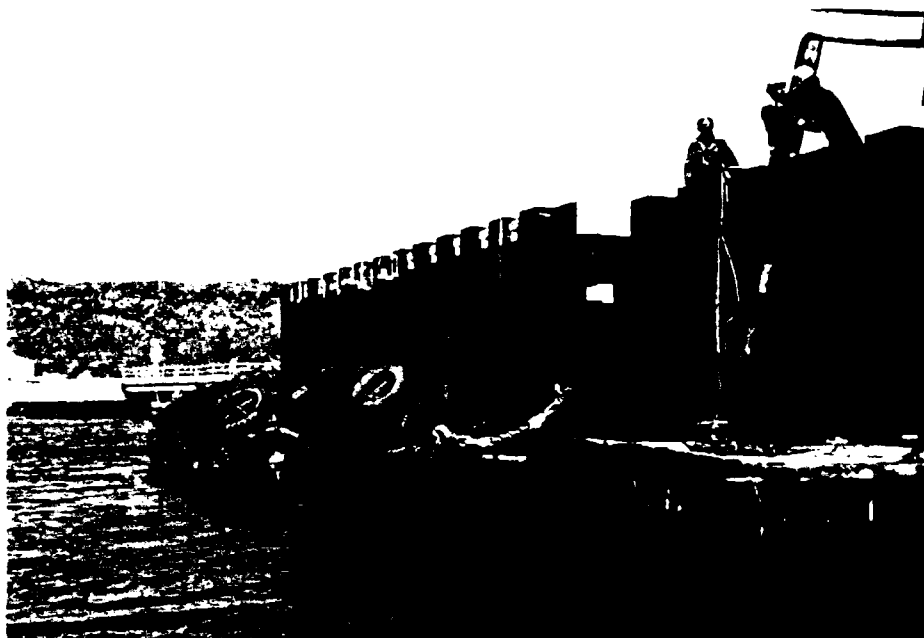
NEW NORTH DOLPHIN  
Looking North at a 16-Inch Conveyor Positioned to  
Place Crushed Stone. Note Sheet Piles Cutoff to  
Uniform Elevations.



NEW NORTH DOLPHIN  
Crushed Stone Fill Placed by Conveyor. The Men Are  
Shoveling Stone Beneath the Waler and Against the  
Sheeting to Fill the Voids and to Prevent Stone  
From Arching.

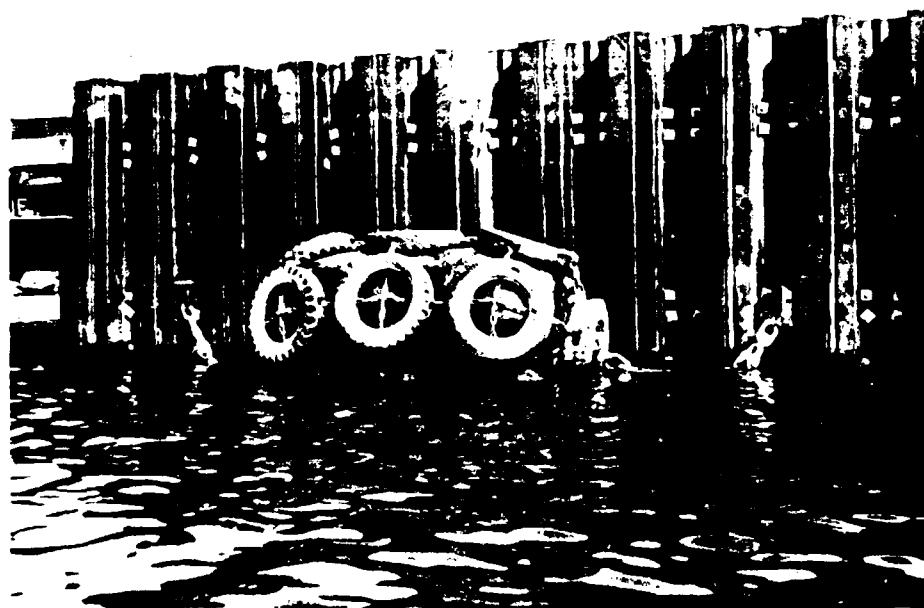
SEPT-OCT 1980 - DURING CONSTRUCTION

P-13



#### LOADING PLATFORM - TIMBER FILLER

Placing Timber Fillers, Between the Sheet Pile Flutes, at the North End of the Loading Platform, to Form a Flat Bearing Surface for the Floating Fender Units.



#### SEA CUSHION FENDER

Temporary Tie Up at the New North Dolphin. Note Wire Rope Temporarily Serving as a Shackle, to Connect the Chain to the Sheet Pile Pad Eye.



NEW NORTH DOLPHIN AND LOADING PLATFORM  
Overall View, Looking Southeast. Note That All  
Sheeting Has Been Installed and Cut Off to Uniform  
Elevations.



LOADING PLATFORM AND NEW SOUTH DOLPHIN  
Overall View Looking Southeast. Note Uniform Sheet  
Pile Cut Off at South End of Loading Platform Fen-  
der Sheeting. Note Non-Uniform Driving and Thread-  
ing of Sheet Piles for the New South Dolphin.



#### NEW SOUTH DOLPHIN

Overall View, Looking North. The North, East and South Walls Are Partially Driven. The South End of the East Wall Is "Hung Up" on an Obstruction About 5 Feet Below the Harbor Bottom.



#### NEW SOUTH DOLPHIN

Looking West at Threading of the West Wall. The Soldier Beam Sheet Piles Are Placed First, Later, the Intervening Sheets Will Be Threaded.



**TIMBER FENDER FILLERS - LOADING PLATFORM**

Timber Fillers Are Cut to Fit Around the Extended Bolts of the Steel Walers. The Cut Recesses Will Be Painted with a Wood Preservative.



**BATTER PILE TIEDOWNS - LOADING PLATFORM**

New Tension Anchor Rods Tie Down the Pile Caps and Deck to Steel Brackets Welded to the West Batter Piles. Tiedowns Have Been Installed at the 5 Southern Batter Pipe Piles



SPAN NO. 2 - APPROACH ROADWAY  
Longitudinal Crack in Facia Beam, About 60 Feet Long,  
to Be Chipped Out and Epoxy Patch Repaired.



DOLPHIN NO. 1 - APPROACH ROADWAY  
Corrosion of the Top of the Old Circular Steel  
Sheet Pile Cell Has Caused Spalling of the Concrete  
Slab. Cleaning and Epoxy Patch Repairs Needed.



#### APPROACH ROADWAY

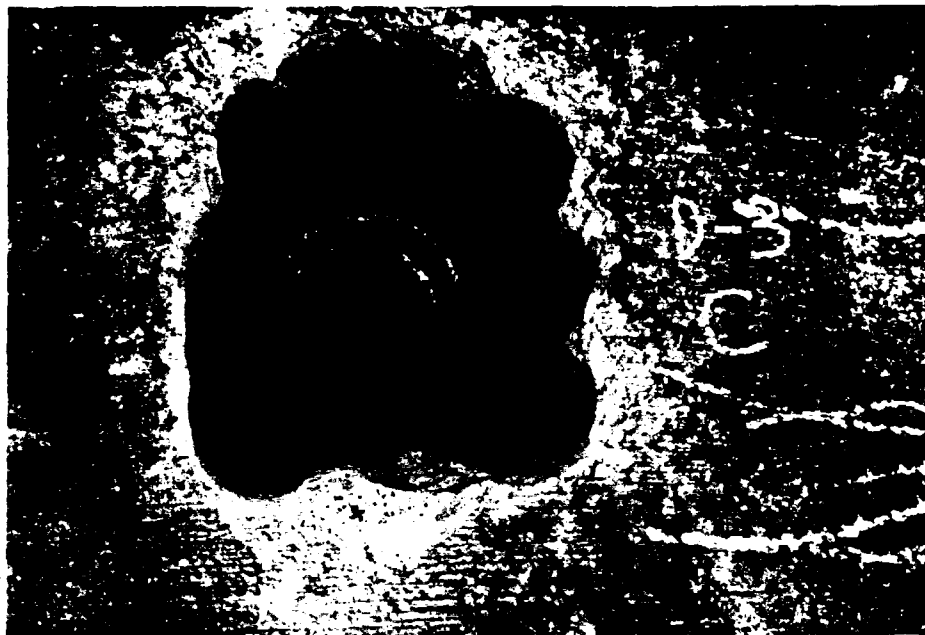
Underside of Deck Showing Cracks and Incipient Scaling. Area Will Have to Be "Probed" with a Jackhammer to Determine the Extent of Deterioration and Then Repaired.



#### APPROACH ROADWAY

Underside of Deck Showing Spalls, with Exposed and Corroded Reinforcement. Note Adjacent Circular Scaling Starting to Form.





#### ROCK ANCHORAGE

Dolphin No. 3 - Center Anchorage with 8 Inch Casing Telescoped Inside the 10 Inch Casing. Note Smooth Drilled Concrete Cap Opening Which Will Have to Be Undercut, Roughened and Reinforced.



#### ROCK ANCHORAGES

Dolphin No. 4 - The Large Drill Rig Provides Power and Weight to Hold Down the Cantilevered Extension on Which the Small Drill Rig Sits, to Drill a Battered Rock Anchorage

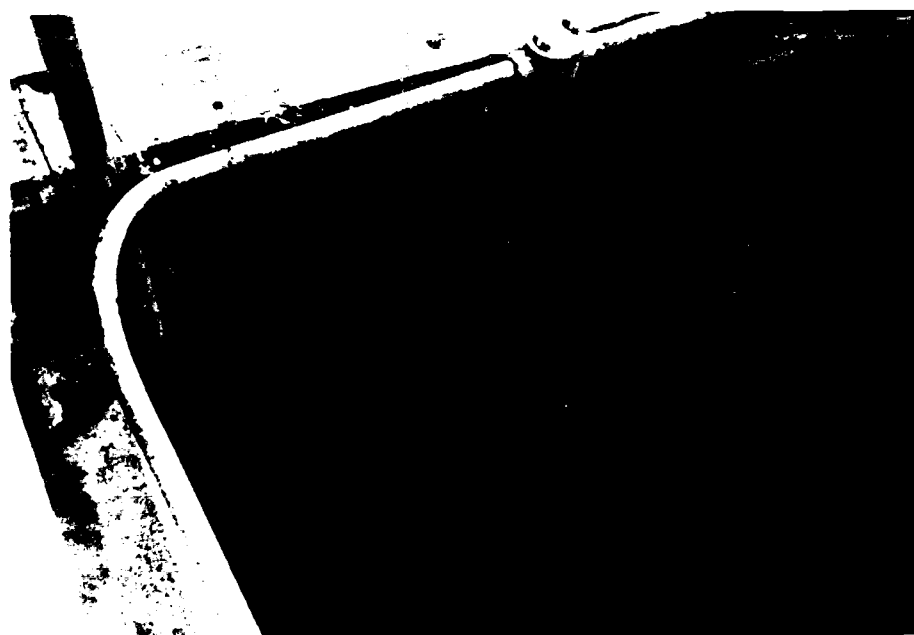
ROCK ANCHORAGE  
REINFORCING CAGE  
General View Showing Staggered  
4 Bars, with Total Length of  
About 40 Feet



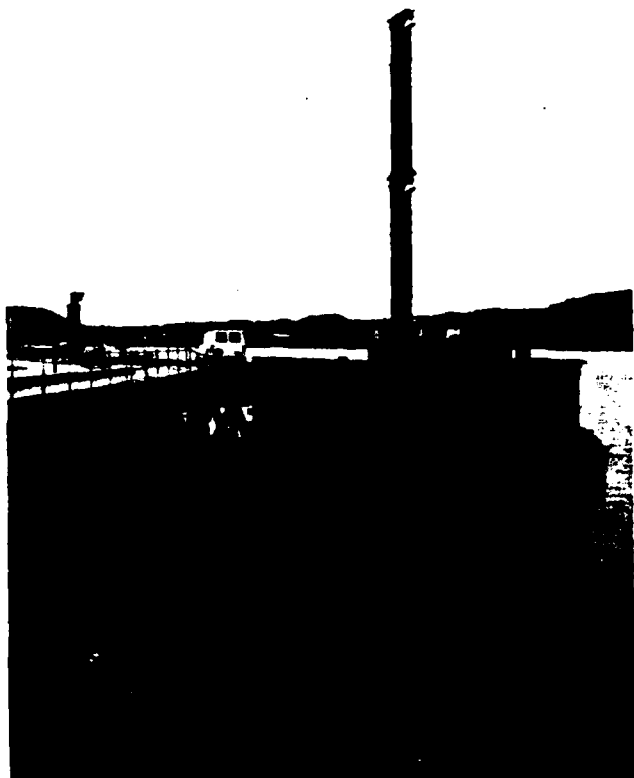
ROCK ANCHORAGE  
REINFORCING CAGE  
View of the Tip, Where the 4  
No. 11 Bars Converge. Entire  
Assembly Will Have to Fit Into  
a 6 or 8 Inch Diameter Hole,  
15 Feet Long, Drilled Into  
Bedrock.



POL PIER - OVERALL VIEW  
New construction - generally completed.



APPROACH ROADWAY  
Typical longitudinal crack in concrete fascia beam  
- above the steel girder.



# NEW NORTH DOLPHIN

Looking south from Dolphin No. 2.  
Temporary construction shed on  
the New North Dolphin, with new  
light pole extending above.



# NEW NORTH DOLPHIN

Looking north at the extreme northwest corner of  
the steel channel cap, bent down by a ship, warp-  
ing on departure.

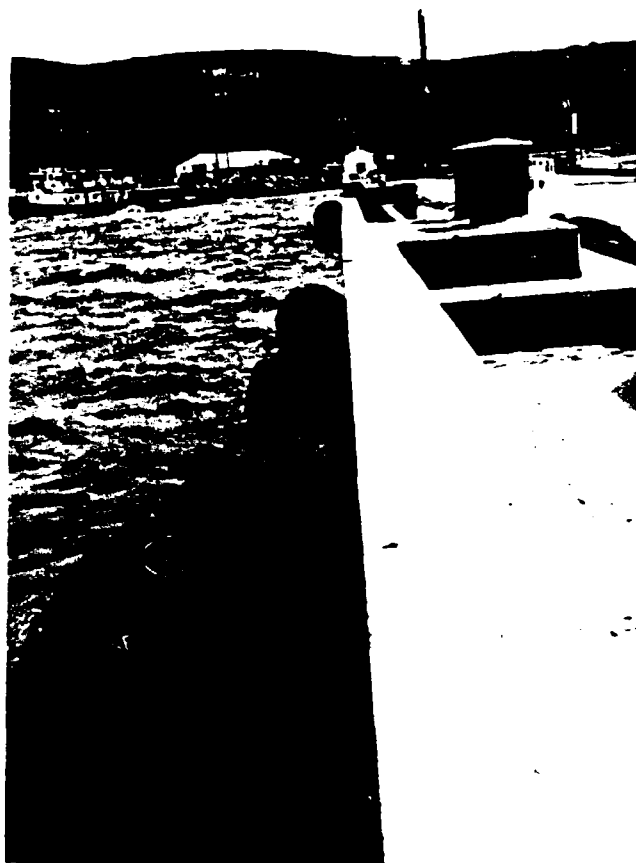


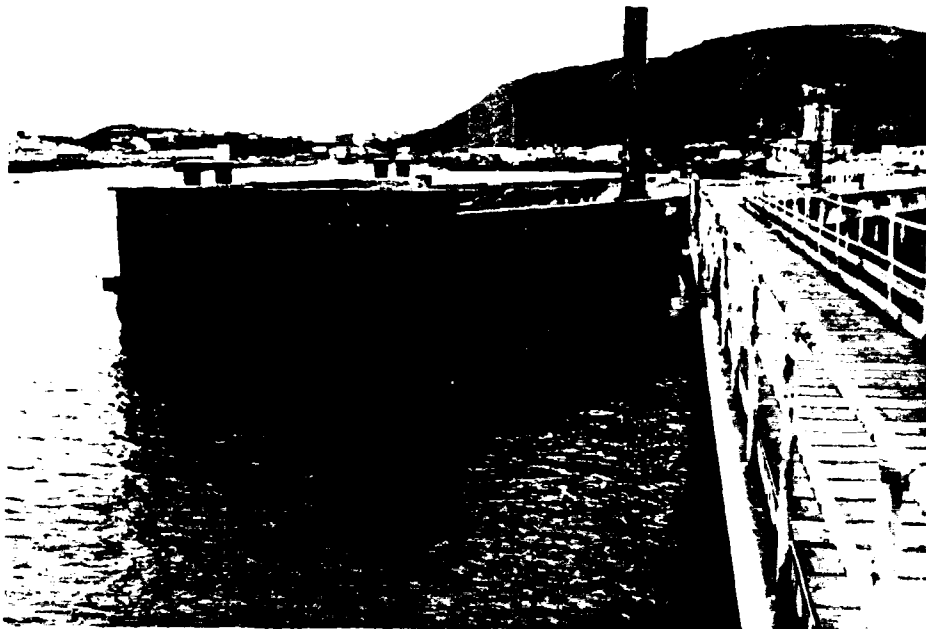
#### LOADING PLATFORM

Looking north at new steel  
sheet pile fendering in front.

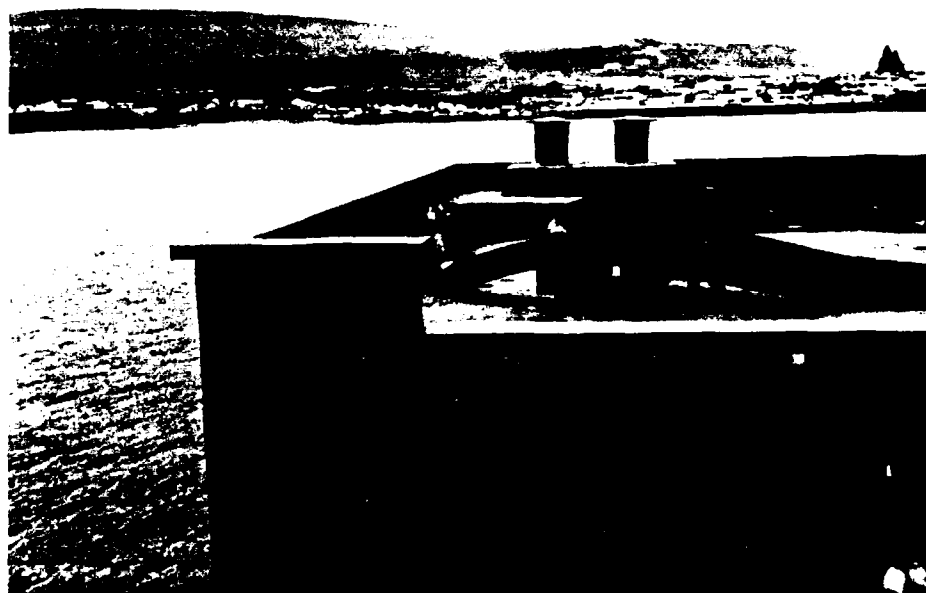
#### SEA CUSHION FENDERS

Looking north from the New  
South Dolphin, down the full  
length of the Pier.





NEW SOUTH DOLPHIN  
Looking north from Dolphin No. 3.

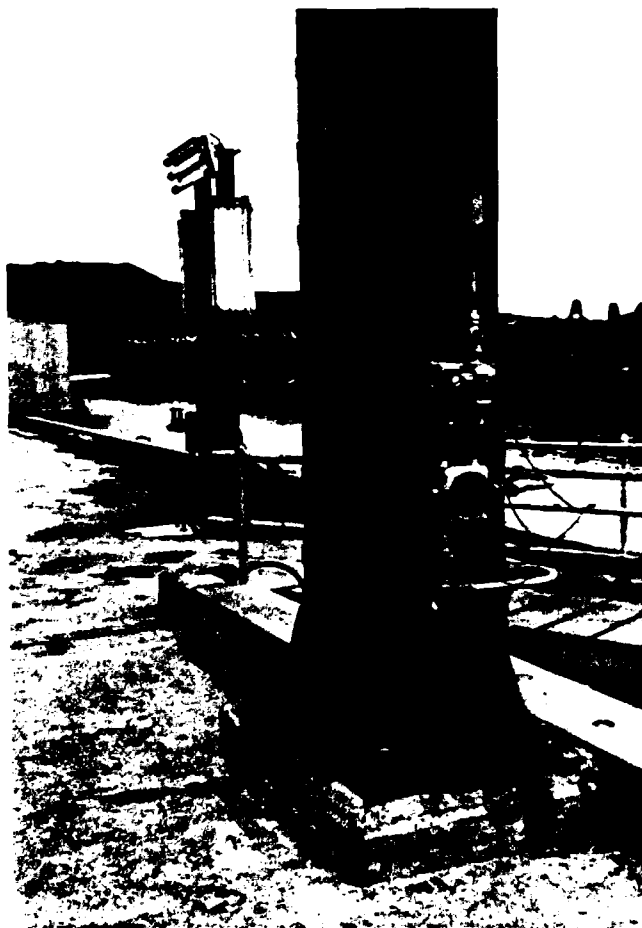


NEW SOUTH DOLPHIN  
Looking west at south end showing the construction details and hoses.



#### NEW SOUTH DOLPHIN

Looking south along the east face. Note that the top of the steel sheet piling was bent in, beneath the steel channel cap.



#### NEW LIGHT POLE

Typical details of conduits, ladder and safety hook pipe.



NEW DELTA RUBBER FENDERS  
looking north, along  
Dolphin No. 4.



ROCK ANCHORAGES  
Looking south at Dolphin No. 4  
with rig on top to install rock  
anchor casings and reinforce-  
ment.





ROCK ANCHORAGE

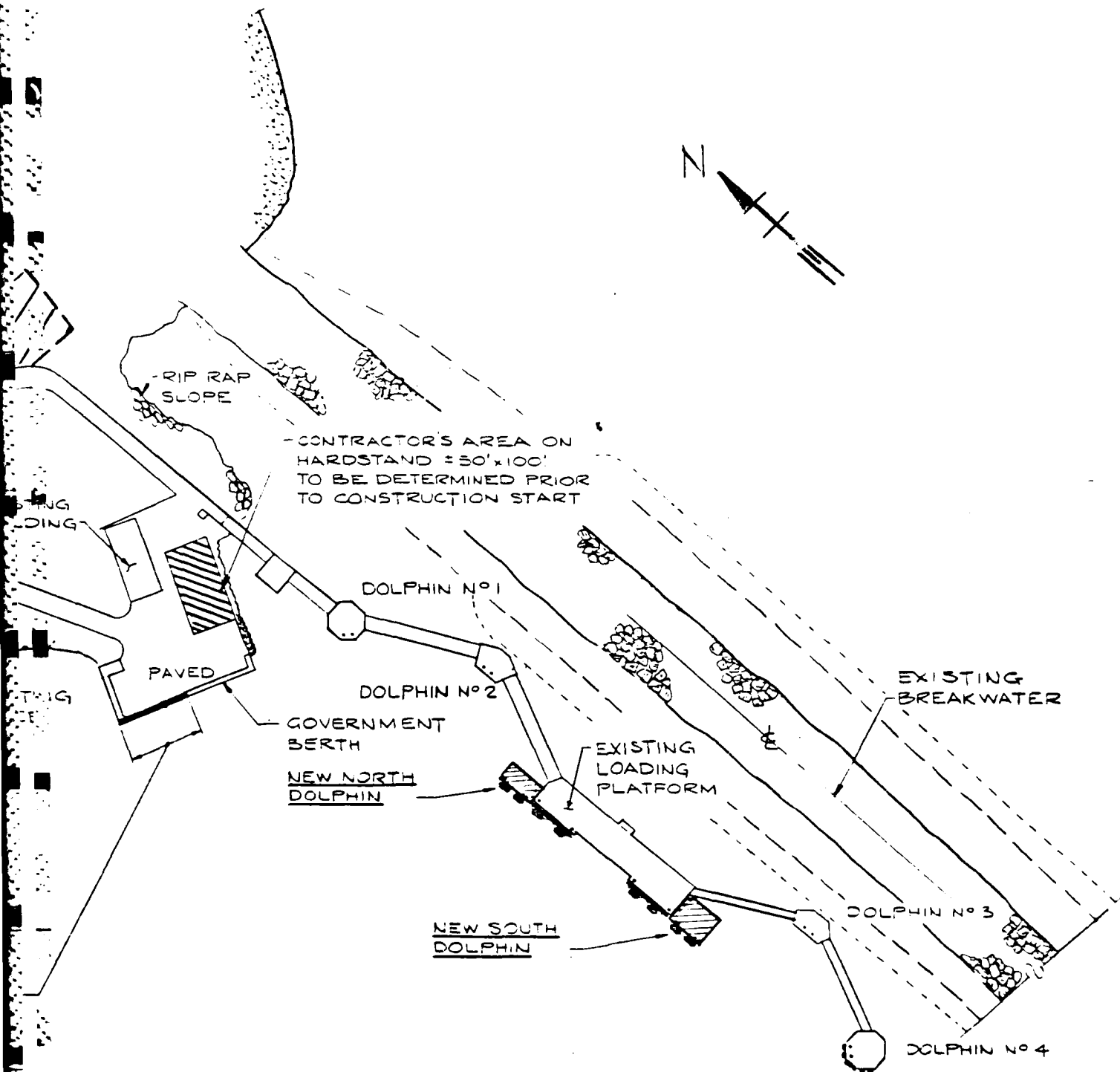
Dolphin No. 4 - Drilled opening in the concrete cap, for the casing.



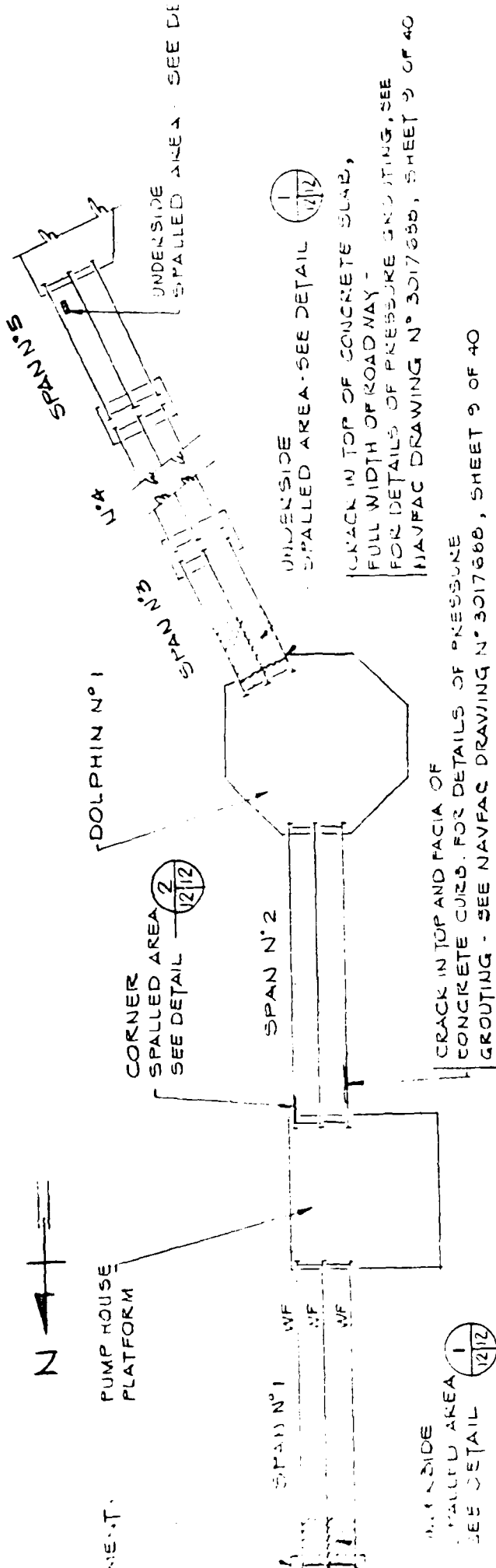
ROCK ANCHORAGE

Dolphin No. 4 - Reinforcing rods are set into the casing and the rock socket.

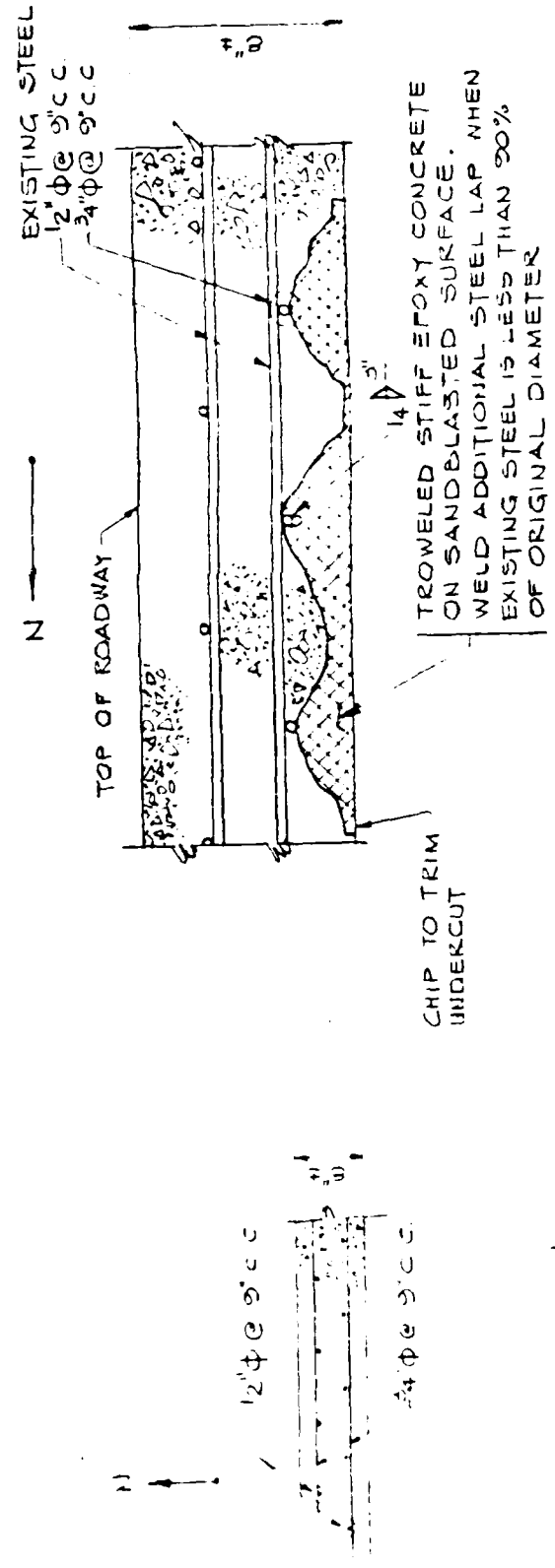
EXCERPTS FROM CONTRACT DRAWINGS



- PRAIA BAY -

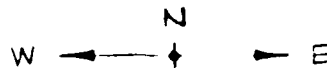


PLAN  
1/16" = 1'-0"



CROSS SECTION





BENTS 1 TO 5 AND 2 TO 6

POCKET IN CONCRETE DECK  
FOR ANCHORAGE TIE DOWN,  
GROUT AND PATCH AFTER TENSIONING PILE-

EXISTING REINFORCING STEEL  
TO REMAIN INTACT

BENTS 12 TO 16  
EXISTING VOID  
OVER PILE

EXISTING  
REINFORCING

1/4"  $\phi$  - THREADED  
ANCHOR ROD  
(TYPICAL)  
(2 PER PILE)

FABRICATED ANGLE PLATE  
FOR ANCHORAGE TIE DOWN

LEVEL SURFACE  
- 1" GROUT (TYPICAL)

BENTS 2 TO 6  
CHIP OUT POCKET FOR  
ACCESS TO VOID ABOVE PILE  
FILL VOID AND POCKET AFTER  
PILE TIE DOWN IS COMPLETED

2"  $\phi$  DRILLED HOLE, GROUT  
AFTER TENSIONING PILE

3/4" THICK STEEL PLATE -  
BRACKET WELDED TO STEEL  
BATTER PILE (TYPICAL)

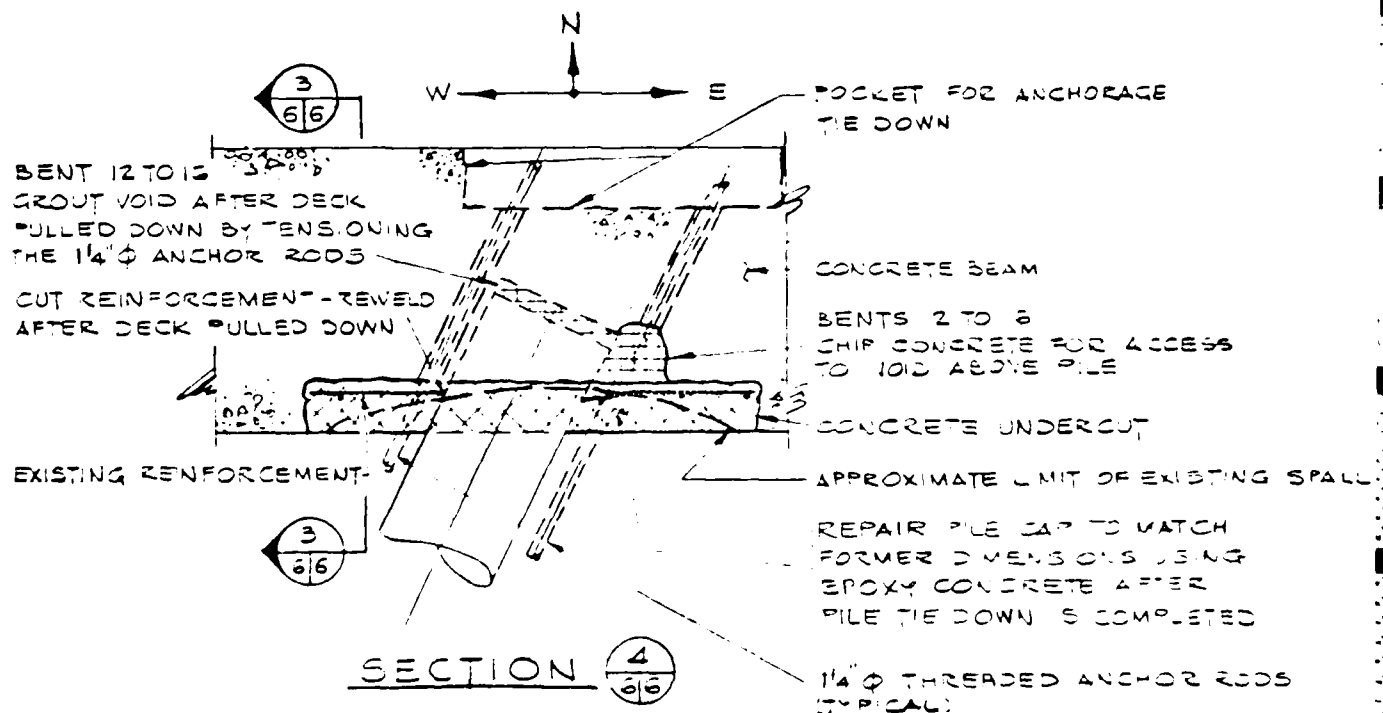
SECTION

2  
6/6

ER PILE TIE-DOWN

1 TO 5 AND 12 TO 16 INCLUSIVE

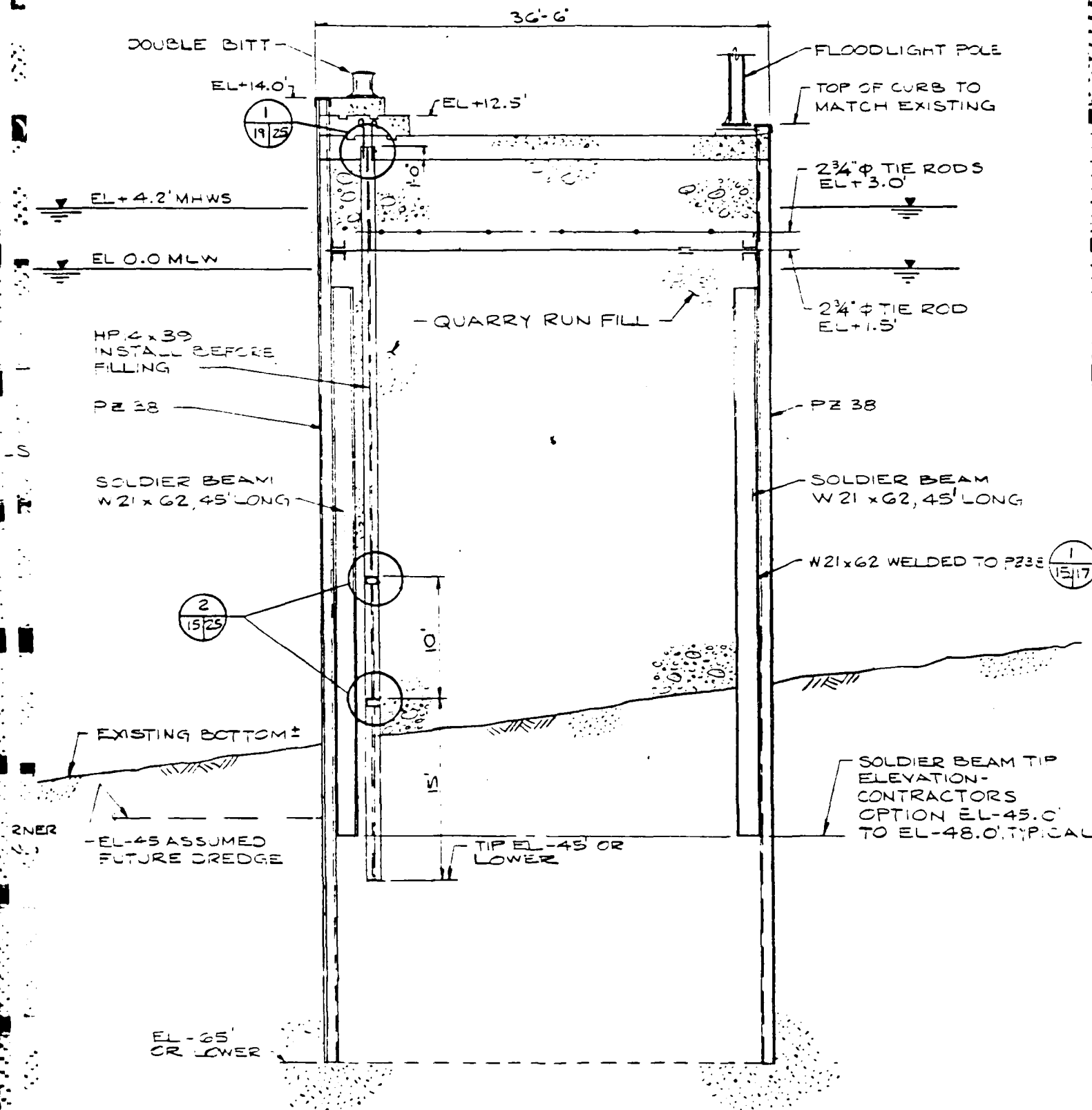
1" = 1'-0"



SECTION

4  
6/6

RE AT WEST BATTER PILES

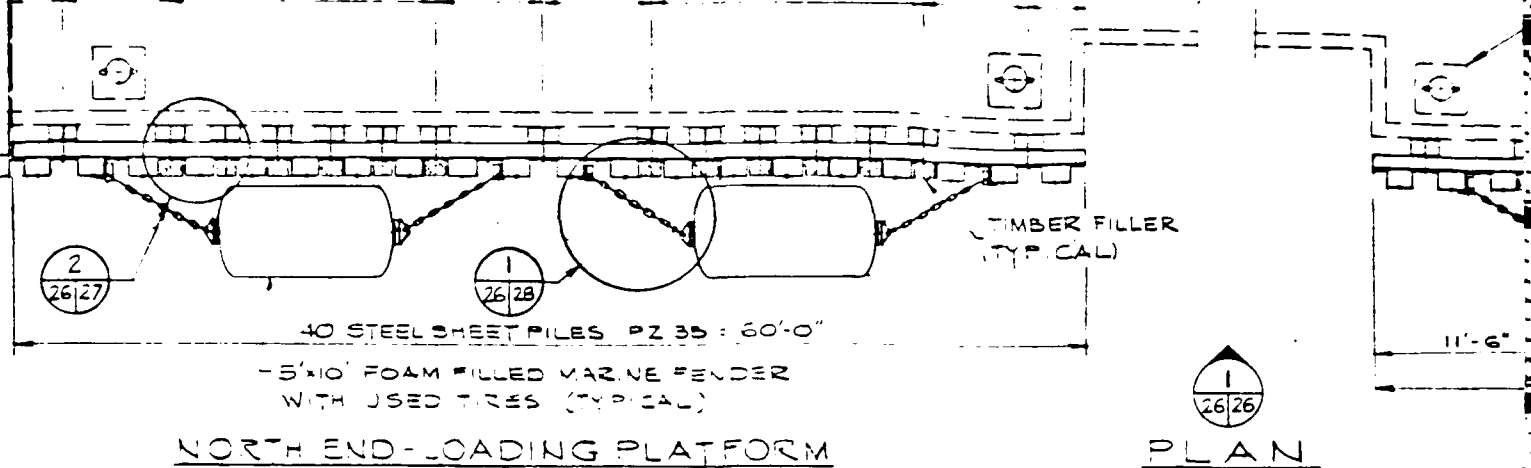


SECTION

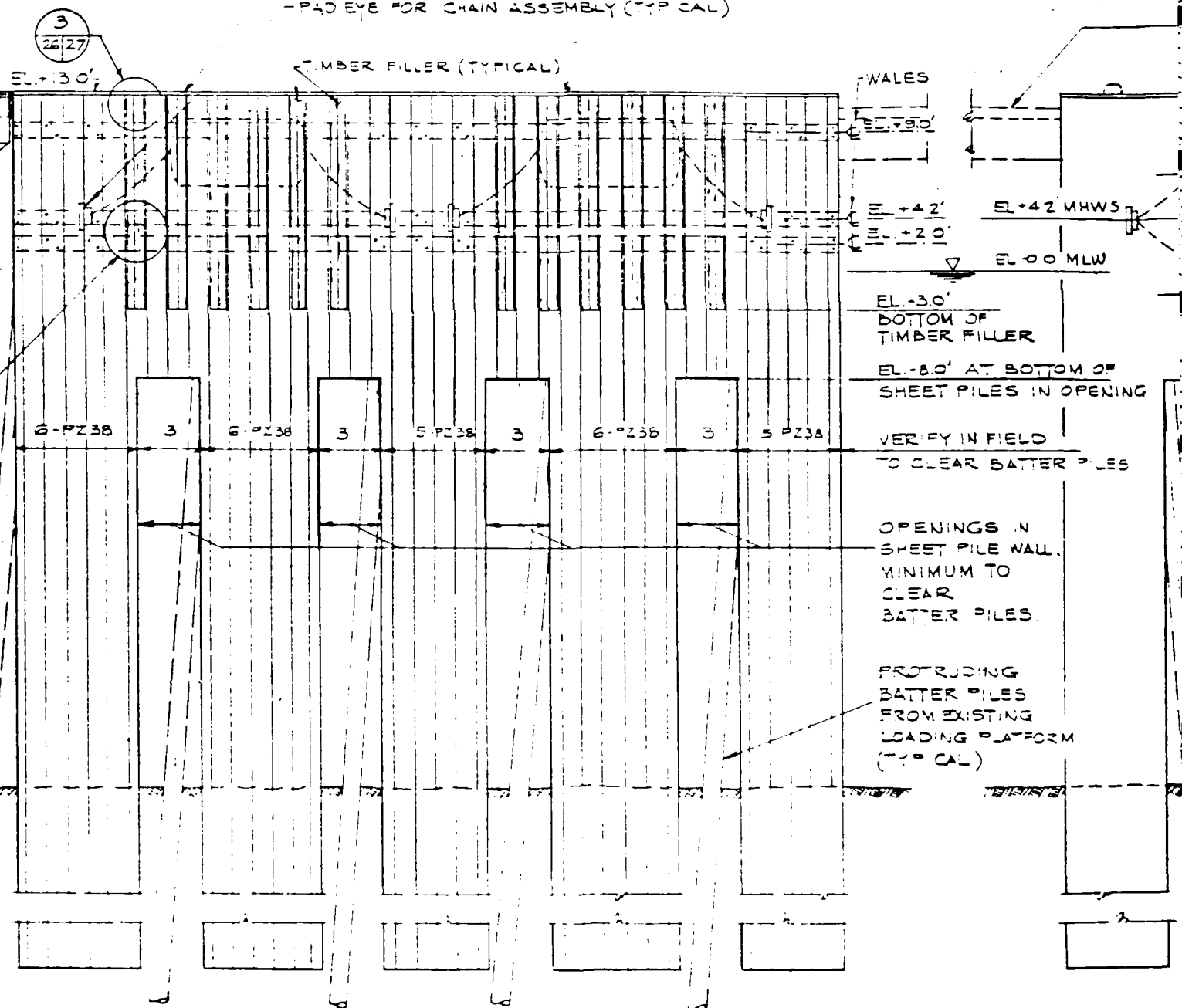
3/16" = 1'-0"



3'-0" 6'-0" 5 SPACES-3'-0" EA. 3'-0" 6'-0" 5 SPACES-3'-0" EA. 3'-0" 3'-0"



CURB - C15 x 33.9  
- PAD EYE FOR CHAIN ASSEMBLY (TYPICAL)





STEEL PIPE TO  
EL-55.0' TYPICAL

NEW  
TYPICAL TENSION  
ANCHORAGE

CATWALK

10"±  
STEEL PIPE TO  
EL-60.0' TYPICAL

2' TYPICAL

# PLAN - DOLPHIN N° 4

NOTES. 1- FOR CATHODIC PROTECTION SEE  
NAVFAC DRAWING NO 3017719, SHEET  
40 OF 40.

2- ALL 8"± STEEL PIPE SHALL HAVE A  
MINIMUM WALL THICKNESS OF 0.322".

3- ALL 10"± STEEL PIPE SHALL HAVE A  
MINIMUM WALL THICKNESS OF 0.365".

4- ALL 8"± AND 10"± STEEL PIPE SHALL  
BE BUTT WELDED.

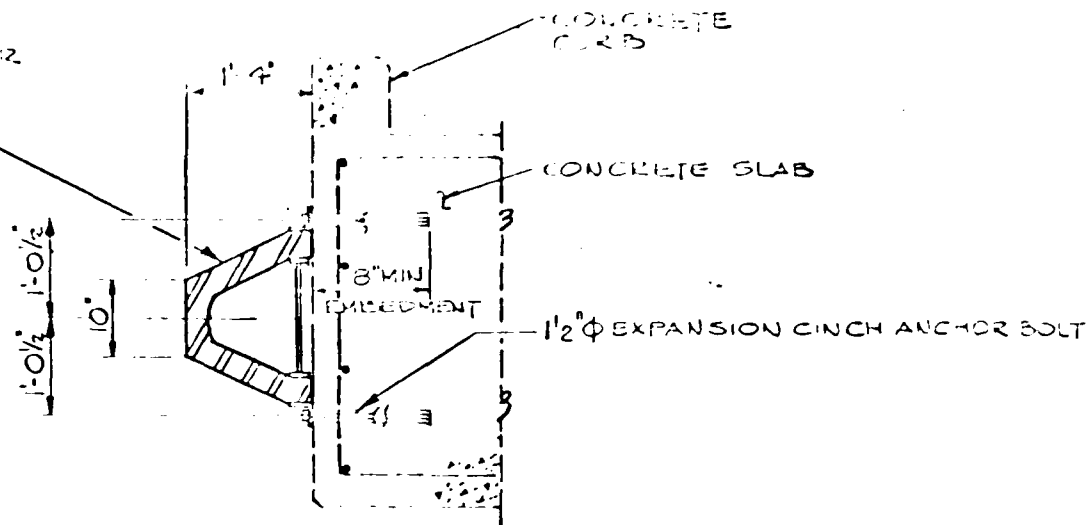
5- FOR BED ROCK ELEVATIONS SEE  
C OF E DRAWING N° AW 22-0-02

REMOVE ALL  
OBSTRUCTING  
PIPELAP

EL-60.0

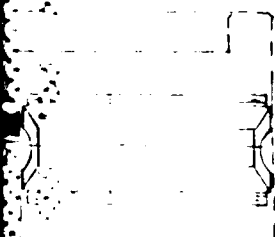
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DETAILED PER FIG. 12  
2'-0" LONG.



SECTION 4  
1" = 1'-0"

TO FACE

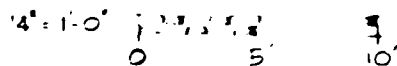


CONCRETE FACE



ELEVATION 3

GRAPHIC SCALES



CHECK GRAPHIC SCALES BEFORE USING

Civil Engineering  
and Construction  
Department  
University of Maryland  
College Park, Maryland

Department of the Navy  
Naval Facilities Engineering  
Chesapeake

CONSTRUCTION INSPECTION VISIT NO. 4

POL PIER REPAIRS  
LAJES FIELD, AZORES

CONSTRUCTION INSPECTION VISIT NO. 4  
JUNE 4 TO JUNE 10, 1981

CONTRACT NO. N-62477-79-C-0021  
MODIFICATION P-00003

THE DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING COMMAND  
CHESAPEAKE DIVISION  
WASHINGTON, D.C.

BY

OLKO ENGINEERING  
CONSULTANTS - DESIGNERS  
15 WEST 36 STREET  
NEW YORK, NY 10018  
(212) 279-2822

## INDEX

	<u>Page</u>
PERSONNEL . . . . .	1
GENERAL WORK PROGRESS . . . . .	1
GENEPAL WORK REMAINING . . . . .	2
GENERAL TIME SCHEDULE . . . . .	5
CONTRACTOR'S WORK FORCE . . . . .	5
STEEL BARGE AND CRANE . . . . .	5
ROCK ANCHORAGES . . . . .	6
BATTER PILE TIE DOWN AT LOADING PLATFORM . . . . .	7
EPOXY PRESSURE GROUT REPAIRS OF LOADING PLATFORM . . . . .	7
NEW NORTH DOLPHIN . . . . .	9
FENDERING AT NW CORNER OF NORTH DOLPHIN . . . . .	11
NEW SOUTH DOLPHIN . . . . .	16
SHEET PILE FENDERING FOR LOADING PLATFORM . . . . .	18
SEA CUSHION FENDERS . . . . .	19
APPROACH ROADWAY - CONCRETE AND APPURTANCES . . . . .	21
Span No. 1 - Topside . . . . .	21
Pump House . . . . .	22
Span No. 2 - Topside . . . . .	22
Dolphin No. 1 - Topside . . . . .	23
Span No. 3 - Topside . . . . .	23
Span No. 4 - Topside . . . . .	23
Span No. 5 - Topside . . . . .	24
Dolphin No. 2 - Topside . . . . .	24
Span No. 6 - Topside . . . . .	24
Span No. 7 - Topside . . . . .	25
WALKWAY BETWEEN DOLPHIN NOS. 3 AND 4 . . . . .	26

(Continued)

# INDEX

	<u>Page</u>
FENDERS AT DOLPHIN NO. 4 . . . . .	28
ELECTRICAL WORK . . . . .	29
CATHODIC PROTECTION . . . . .	30
DANAC STORAGE SHED . . . . .	32
CONTRACTOR'S CLAIMS . . . . .	32
CONCRETE BLOCK WHARF CORNER . . . . .	33
FUTURE HARBOR WORKS . . . . .	33
AS BUILT DRAWINGS . . . . .	34
FUTURE INSPECTION VISITS . . . . .	35

POL PIER REPAIRS  
LAJES FIELD, AZORES  
CONSTRUCTION INSPECTION VISIT NO. 4  
JUNE 4 TO JUNE 10, 1981  
CONTRACT NO. N-62477-79-C-0021  
MODIFICATION P-00003

S. M. Olko arrived at Lajes Field, Azores on Thursday, June 4, 1981 and inspected construction progress of repairs to the POL PIER, leaving Lajes Field on Wednesday, June 10, 1981. This was the fourth and last Construction Inspection Visit.

PERSONNEL

The following military and Contractor's personnel were met during the Site Visit:

Mr. Raymond Armbrust	NAVFAC Norfolk, Virginia
Mr. Thomas Maggio	Construction Inspection
Lt. Col. David Brooks	Base Civil Engineers
Capt. Kinman	Base Civil Engineers
Mr. George Lief	Base Scuba Diver
Col. Nelson Maier	Army Transportation Terminal Unit
Maj. Peter Ferguson	Army Transportation Terminal Unit
Sgt. Charles Breuster	Army Transportation Terminal Unit
Mr. Ole Sorensen	DANAC, Inc. General Manager
Mr. Farina	DANAC, Inc. General Superintendent
Mr. Aksel Larsen	DANAC, Inc. Electrical Superintendent

GENERAL WORK PROGRESS

Overall, there was moderate progress on the job, since the last inspection visit of October 1980, 8 months earlier.



DANAC indicated they had a great deal of difficulty in obtaining aggregate for both concrete and the internal cell fill. Following the earthquake, the Portuguese Government restricted use of crushed stone from the Government quarry for "emergencies" only, such as the rehabilitation of damaged homes, etc. Also, severe storms during the winter caused damage and further delayed the work.

Apart from such difficulties, the somewhat slow progress on the job is attributed to inadequate manpower and equipment. DANAC is working on several projects in the Azores, and have dispersed their manpower.

#### GENERAL WORK REMAINING

To better understand the status of job progress, the following is brief summary of the basic construction work remaining:

Dolphin No. 4 Anchorages: Place all rebars and grout the rock anchors. By the end of the visit, one anchor was completed, and work remained on the other 5 anchors.

Loading Platform Grouting of Cracks: Epoxy grout all deck & beam cracks at the south end of the Loading Platform.

Loading Platform - Batter Pile Tiedowns: Install 5 west batter pile tiedowns, at the north end of the Loading Platform.

Electrical Work: Complete the installation of electric power & lights and cathodic protection.

In addition to the main items listed above, the following are other, somewhat minor works remaining, under the basic contract:

1. North & South Dolphins - Closure of 2-inch gaps in sheet pile channel caps, for cathodic protection continuity.
2. Loading Platform - Replace ripped protective rubber tire on south Sea Cushion fender.
3. Loading Platform - Bolt safety device tube to rungs of Floodlight towers.
4. Dolphin No. 3 - Cut off the abandoned rock anchor casing, at the harbor bottom.
5. Dolphin No. 4 - Repair the concrete facia with epoxy patches.
6. Generally - Grind down rough concrete surfaces and chamfers for appearance and improved drainage.
7. Generally - Remove all miscellaneous temporary construction brackets.
8. Generally - Clean out all expansion joints and scuppers.
9. Generally - For corrosion protection - finish the painting/coating and touch-up of all abraded surfaces.

The following items of work, are outside the Basic DANAC contract, but were to be accomplished, either by DANAC or another contractor;

1. Approachway - additional spalled and cracked concrete repairs.
2. Approachway and walkways - repair railings and replace some cracked concrete planks.

3. North Dolphin - install additional fendering at NW corner to protect ships while warping on departure.
4. Old pier - upgrade the electric power lighting and cathodic protection system.
5. Old Pier - repaint all steelwork.
6. Tugboat Wharf - replace missing concrete block at NW corner.

The following are a list of submittals to be made by DANAC, upon completion of all work:

1. As built record drawings
2. Daily construction reports
3. Pile driving records
4. Rock anchor records
5. Dolphin fill settlement records
6. Underwater inspection reports
7. Test coring of concrete reports
8. Concrete compression test reports
9. Surplus property disposal report
10. Electrical spare parts listing
11. Seacushion fender maintenance manual

All of the above "remaining work" was discussed with Messrs. Sorensen, Larsen, Armbrust, Maggio, Col. Brooks and Capt. Kinman on June 10, 1982 - prior to leaving Lajes. A four page hand written list of "remaining work" was distributed at that time.

### GENERAL TIME SCHEDULE

Based on discussions with DANAC, all work is scheduled to be completed by the end of July 1981.

The time schedules given by DANAC, for specific outstanding items are as follows:

1. Batter pile tiedowns (5) at north end of Loading Platform - install at the end of June.
2. Grouting of cracks in Loading Platform - begin around June 15. The work will be performed about 1 week between ship berthings.
3. Approachway concrete repairs - begin around June 15 - finish in about 6 weeks.

Based on previous progress - it is questionable that this schedule will be met. DANAC is involved with a number of other projects that have assumed a high priority.

### CONTRACTOR'S WORK FORCE

The present work force consists of about 10 people, working one shift. This should be compared to the previous work force of about 30 people, when the work was in full progress.

### STEEL BARGE AND CRANE

The steel barge, used as a platform for the 60-ton crane, was disassembled. The barge was cut up into sections and portions were sold locally, or the steel was used for other work.

The 60-ton crane was shipped back to the U. S. A.

#### ROCK ANCHORAGES

Rock anchorages have been installed at Dolphins Nos. 2 and 3, but not at Dolphin No. 4.

It is understood that at Dolphin No. 3 there was a problem in that a drill bitt stuck in one of the holes. This hole was abandoned, and an adjacent anchorage was installed.

At Dolphin No. 4 all of the holes have been drilled for the 6 anchors, but none of the anchors had been installed, prior to this inspection visit. However, during the visit, the northwest anchorage was installed and grouted. Work then proceeded on the northeast anchorage.

In inspecting the work at Dolphin No. 4, two items were noted, contrary to the specifications. First, cleaning out of the hole, prior to pumping the grout; and second, the reinforcing steel was all cut to the same length, without staggering the splices.

With regard to cleaning out the hole, it had previously been agreed that this would be done using the grout pipe and compressed air. DANAC indicated that this was not necessary based on previous anchorage installations, as the water always came out clean. However, it was pointed out that unlike the

other anchorages, the holes at Dolphin No. 4 had been left open for more than half a year, and there was concern that debris or algae growth could reduce the effective bonding of the grout. It was agreed, then, that all 6 holes would be cleaned out, scouring with compressed air for a couple of hours to clean the hole in the rock.

Regarding the staggering of the reinforcing steel, this was an error, which had not occurred with the previous anchorage installations. It was corrected.

#### BATTER PILE TIEDOWN AT LOADING PLATFORM

The five tiedowns, at the north end of the Loading Platform, had not been installed. The deck has to be cut out and the tiedowns placed to engage the batter piles of the Loading Platform.

It is expected that this work will be accomplished by the end of June 1981.

#### EPOXY PRESSURE GROUT REPAIRS OF LOADING PLATFORM

Repair of concrete cracks at the south end of the Loading Platform, by pressure injection of epoxy, was not completed. This was surprising, as previous information indicated this work was finished. Also, this was a "high priority" item - and to some extent the concrete repair work was the catalyst for the entire pier rehabilitation project.

DANAC indicated that they chipped out the cracks and there were no visible cracks, even with a magnifying glass. Having concluded that many of the cracks were "superficial" and could not be grouted, they simply resealed the surface. On the other hand, some of the cracks were visible, and could be grouted. However, these had not yet been grouted, but were identified and temporarily sealed, to prevent grease, debris, etc. from entering the cracks.

It was pointed out that the original cracks were somewhat sealed in that unfortunately, during one of the unloading ship operations, cement was dropped on the deck of the Pier. The cement bags opened, and with subsequent rain, formed a cement slurry mixture which penetrated some of the cracks and sealed them. This was not a full bond epoxy sealing, but simply a cement wash, that filled the cracks, but could be washed out with water under pressure.

Accordingly, it appears that even the fine hairline cracks, can be pressure grouted, using a nonviscous epoxy suitable for this purpose, as specified. The work will proceed on this basis.

The Contractor has suitable air compressors for cleaning, epoxy grout, and pumping equipment on the jobsite, as well as the equipment required for taking cores, to test the quality of the grouting, in accordance with the specifications.

The Contractor is planning to begin the pressure epoxy grouting work around June 15, 1981, and the grouting is expected to take about 1 week to complete, working between ship berthings and allowing sufficient time for the epoxy to cure.

#### NEW NORTH DOLPHIN

The steel sheeting of the new North Dolphin requires considerable touchup on the exterior surfaces. The corrosion protective coating had been abraded during handling. In some areas there is evidence of touchup, but apparently not all areas were corrected, or after the touchup, additional abrasion occurred.

In addition, temporary brackets and other items that were used during construction, should now be burned off, smoothed and touched up.

At the northwest corner of the North Dolphin, there has been some damage to the channel on top of the sheeting, due to ships warping around this corner, during departure. This is described in detail in the following section.

On the west side of the North Dolphin, immediately north of the bollard, there is a 2-inch gap between the two sections of top channel. This is not a satisfactory detail as it is possible to catch a mooring line in this gap. A closure piece should be welded across, so that the rope can slide over.



Also, the channel must be continuous, for conveyance of the cathodic protection current.

Also, further south on the west channel, between the North Dolphin and the Loading Platform, there is another 2-inch gap. The drawings do show a 2-inch expansion joint at this location, but here again, it would be desirable to weld a closure piece so that mooring lines could slide over, without getting caught. The Contractor agreed to weld a plate.

The concrete cap of the North Dolphin is generally sloped for drainage, although some ponding was noted between the two bollards on the west side of the dolphin. Some minor grinding of the concrete would resolve this problem, directing drainage towards the scupper.

The main criticism of the concrete cap, placed on the North Dolphin, is the surface finish. It appears that the surface was prepared rather poorly, including some areas that almost look like patchwork. In addition, it appears that it had rained, after the concrete had been placed, washing off some of the top surface. Altogether, the surfacing is very poor.

It is recommended that the concrete surfacing be ground so as to present a more uniform appearance. Also, in some areas, there are small spalls and additional patchwork is required. The Contractor agreed to correct these areas.

The double bitts had been installed properly and are flush with the top of concrete.

It is noted that at the north end of the southernmost double bitt, the step-up is 3 ft. wide, rather than 2 ft. wide, as shown on the drawings. However, this is of no consequence. It is acceptable.

The concrete work around the double bitts, at both the north and south ends of Dolphin No. 1, is not of the very best quality. The chamfers are not smooth, and there is some minor honeycombing. It would be desirable to grind the concrete, thus eliminating some of the roughness. The Contractor agreed to make corrections.

The light pole at the extreme northeast corner of Dolphin No. 1 is in position, and looks satisfactory, but is not yet electrically connected. The other work remaining on the pole are paint touchups. It was noted that the vertical safety pipe, at the center of ladder, was not yet bolted to the rungs. The bolts were inserted without the nuts. Also, there is some corrosion where the base plate was abraded during erection of the pole. Paint touchup is required.

#### FENDERING AT NW CORNER OF NORTH DOLPHIN

Additional fendering is required at the northwest corner of the North Dolphin, to facilitate ship departure.

With the ship headed south, the unberthing procedure, used by the pilots, is to have one tug push at the stern, toward the east (towards the pier) while another tug pulls out the bow, towards the west, causing the ship to rotate at its stern, about the northwest corner of the new North Dolphin. When the ship heads southwest, it departs, keeping away from the pier and other dolphins, such as No. 4 to the south, and also clearing the breakwater. However, since the sterns of vessels are flared, they override the new Sea Cushion fenders. The stern of the vessel strikes the extreme northwest corner of the North Dolphin, as it rotates. This has occurred on at least one occasion, but with no ship damage.

In examining the NW corner, the damage that has occurred is very minor. The steel channel cap, on top of the sheet piling of the new North Dolphin, makes a right angle turn at this extreme corner, and due to the configuration of the sheeting below, there is no vertical sheet pile immediately below the corner. Instead, the channel is unsupported. To some extent, this is fortunate in that deflection of the corner prevented damage to the ship. On the other hand, if a sheet pile was directly under this corner, then the corner would probably not have deflected.

The deflection of the channel is very little. The extreme corner point went down about 2½ inches. A triangular shape defines the damaged corner extending 27 inches south from the corner, and 17 inches eastward.

One possibility, to eliminate this problem, would be to modify the ship departure procedures, using tugs to first pull the ship off, parallel the Pier, rather than rotating around the North Dolphin corner. The procedure would be to have one tug pull on the stern, perpendicular to the vessel, while another tug would be at the bow, either pulling or pushing the ship, toward the west. Both tugs would move the vessel off, parallel to the Pier and then, the bow tug would pull in a southerly direction, so the ship would head out to sea. The problem is, however, that the old 1200 HP tugs have a bollard pull of only about 15 to 18 tons. Consequently, they do not have sufficient power to pull against a strong wind or heavy sea.

In addition, the tug pulling the vessel off the stern, must have very short lines - only about 150 ft. long, since about 300 feet off the Pier, the Harbor has silted in and is too shallow for the tug to travel in a westerly direction, perpendicular to the Pier. Furthermore, off in this westerly direction and interfering with the stern tug, is a mooring buoy which the Army uses to tie up some of the vessels, when they are loaded or unloaded with an LST and do not berth at the Pier itself. Accordingly, the maneuvering area for the stern tug is limited. Although the tugs draw only about 13 to 14 feet, the water in the last half year has shallowed to such an extent that even during high tides the tugs hit bottom about 300 feet west of the Pier.

The stern tug problem is compounded in that because of the short tow line, when the tug pulls a vessel off, and simultaneously, the vessel heads south, the line component tends to pull over the tug and could cause it to capsize. On one occasion the tug keeled over considerably during this maneuver. Consequently, with short tow lines, pulling the vessel broadside off the Pier could be dangerous and cannot be done, during bad weather conditions.

One possibility, to assist ship departure would be to first have the ship go astern, northward towards the shore, until the flat side of the vessel's hull is alongside the extreme north corner and then, turn about the corner, bearing against the large diameter floating fender, thereby not striking the corner with the flare of the stern. This is possible in good weather, but depending on the sea and wind conditions, this maneuver cannot be done all the time. Furthermore, it may not be possible with some of the ships, depending on their dimensions and overall balance in terms of breasting against the Sea Cushions.

The ships and tugs are owned by the U. S. Army, but the Portuguese pilots have control of operations in the Harbor, and it is difficult to change their departure procedures.

A possible "structural" solution would be to drive timber piles in a cluster around the northwest corner, to form a turning dolphin. However, this would require considerable future maintenance, based on previous problems with timber piles breaking off, crushing, etc.

The best solution is to fender the corner itself. A number of alternatives were discussed in considerable detail. One solution is to use the old rubble fender units that were formerly on Dolphin No. 4, before being removed for the new Delta fenders. There are 25 of these old rubber block fender units, each 1 ft. square, 3 ft. long, with a 4 inch center bored hole. Accordingly, it was agreed that the rubber blocks could be draped, or attached in some fashion around the northwest corner, so as to protect the ship's stern during departure.

As a temporary measure, it was agreed that the web of the sharp steel channel corner would be cut off and rounded by DANAC, welding on to the bent flange, so as to form a rounded channel corner. This would be simple to accomplish, since the corner flange is over an area where the sheeting indents. Care must be exercised however, not to interfere with the navigation light which is attached below.

Modifications will be discussed with the Army Engineers in New York and the Navy in Washington, D. C., to determine if a design sketch should be prepared, using the 25 rubber block fender units that are now in storage. In the meantime, the Army will temporarily protect the NW corner, by placing on top a woven hemp mat, similar to that used on the bows of the tug boats.

## NEW SOUTH DOLPHIN

During construction, before the South Dolphin cell had been completely filled, a ship hit it and bent some of the sheet piling on the west side. The Contractor then bent the sheeting back into position and straightened up the wall. The Contractor (DANAC) made no claims for extra work.

The sheeting was inspected, and appears satisfactory although a couple of the sheets bulge out a few inches beyond the others. However, the strength of the sheeting is not impaired, since the Z-type sheeting of the rectangular cell resists the internal lateral fill pressures in bending, rather than in interlock hoop tension, as would be the case if the cell was circular.

Similar to the North Dolphin, the corrosion protective epoxy coating on the South Dolphin sheet piling has numerous areas where touchup is required. In addition, there are brackets, still welded on, that were used temporarily during construction. These should be burned off, the sheeting smoothed and touched up with an epoxy coating.

Apparently the Contractor had some problems with sheeting alignment, at the extreme east face, near the northeast corner. At two sheets, the tops had to be bent back so as to lie beneath the channel. The top of the inside face of the sheeting also had to be bent, to match the channel.

The west side of the cell apparently presented a difficult situation, in that the sheeting is not in alignment and some of the sheets are bent back at the top so as to fit into the channel cap. Again, this is not serious, although in the middle of this west wall, between the two bollards, there are two sheets which extend out about 2 or 3 inches beyond the other sheets. In a similar manner, at the extreme south end of this west face, there is one sheet that is bent inward a few inches, compared to the other sheets.

Altogether, it appears that the South Dolphin was not lined up as well in the template as the North Dolphin. This might be the result of the ship impact previously described. However, overall, the dolphin is satisfactory,

The channel closure on top of the steel sheet piling seems satisfactory. However, it is not continuous as there are several 2-inch gaps, which could cause problems: first, for a ship's line falling in between; and second, discontinuity of the cathodic protection, since the channel serves as the electrical conduit. This can be corrected by welding filler plates across the gaps.

In general, the concrete cap on the South Dolphin is in better condition than at the North Dolphin. Presumably, it was done with more care, in response to complaints about the workmanship at the North Dolphin. Although satisfactory, the concrete work at this South Dolphin is still not of the best workmanship.



The two double bitts on the South Dolphin appear satisfactory - some paint touchups are needed, but basically the bitts were installed in accordance with the drawing and are more or less flush with the concrete. The southernmost bitt is somewhat recessed into the concrete, tending to collect water. There is some corrosion as a result of this ponding on the north side of this double bitt.

The Sea Cushion fenders are satisfactory at the South Dolphin. All of the chains seem to be galvanized, as well as the brackets connected to the sheeting itself, unlike the North Dolphin, where there was considerable corrosion. Altogether, the fendering system is more satisfactory at the South Dolphin. However, at the extreme south end, the steel member attached to the south wall, used for connecting the chains to the Sea Cushion, was not painted and is corroding.

The light pole at the South Dolphin has not yet been connected, and also requires some touchup coating.

#### SHEET PILE FENDERING FOR LOADING PLATFORM

The walers, for the steel sheet pile fendering system at the Loading Platform, seem to have been properly installed. The only criticism is that they require considerable corrosion protective coating touchup. They are in poor condition, from that viewpoint, and a great deal of miscellaneous matter

has collected in amongst the flanges, etc. Also, some holes were burned in the flange on the east side, apparently in error, and should be coated for corrosion protection.

The steel channel cap, on top of the sheet piling at the north half of the Loading Platform, is in satisfactory condition. However, in the center, where two sections of channel abut, there is a 2-inch gap, presenting an area where mooring lines could fall in between and rip off the channel cap. A closure piece should be welded across so the lines will slide over. In addition, the channel cap needs cleaning and corrosion coating touchup.

At the south half of the Loading Platform, the channel cap on the sheet piling is somewhat distorted, at its center portion, where two sections abut. It appears as if a ship struck the sheet piling at this point, before the Sea Cushion fendering was installed, and bent down the southern half, with respect to the northern half. The distortion is not significant and does not require correction.

#### SEA CUSHION FENDERS

At the new North Dolphin, the two 6 ft. diameter Sea Cushion fenders seem to be in good condition. However, the chain anchorages to the Sea Cushions were not galvanized and some sections already show corrosion. These sections should

be brushed clean and covered with a zinc based paint. Also, the brackets on to which the chains are connected, were not galvanized or painted and are now corroded. All of the brackets have to be wire brushed, cleaned, and zinc painted.

At the new South Dolphin, the Sea Cushion fenders seem satisfactory. All of the chains and brackets were galvanized. At the extreme south end, the steel member attached to the south wall, supporting the chains to the Sea Cushion, was not painted and is corroding. It requires a coating of zinc paint.

At the north end of the Loading Platform, the two 4 ft. diameter Sea Cushion fenders, seem to be in fair condition. However, the southern Sea Cushion at this north end is covered with a gray layer, presumably cement, spilled during unloading of a vessel. This does not present an attractive outer surface, but should eventually wash away. Also, the brackets welded onto the steel sheet piling were not galvanized and are already corroding. They require zinc paint touchup.

At the south end of the Loading Platform, the two 4 ft. diameter Sea Cushions are in poorer condition than at the north end. Here they are completely covered and caked with cement, which presumably fell off while a ship was being unloaded. The two fenders are most unattractive. They should be washed down.

It was noted, on the north Sea Cushion at the south half of the Loading Platform, that a rubber tire at the extreme

southwest surface is ripped, probably caused by a ship berthing. This tire should be replaced now, as a matter of maintenance, even if its condition is not DANAC's fault or responsibility.

#### APPROACH ROADWAY - CONCRETE AND APPURTENANCES

The following summarizes the condition and outstanding work relating to the top side of the concrete and appurtenances of the Approach Roadway. Inspection of the underside, by boat, was not possible, due to weather conditions.

As described in the previous September-October 1980 Inspection Report (No. 3), the Approach Roadway spans are numbered from No. 1 to No. 7, starting at the shore abutment, extending southward to the Loading Platform. The general numbering of these spans, at least to Span No. 5, is shown on NAVFAC Drawing 3017691 (Sheet 12). The September-October 1980 Inspection Report (No. 3) should be used as a guide, for the following descriptions:

Span No. 1 - Topside: Between the shore abutment and the Pump House - on the east side, in the fascia beam above the steel girder, towards the north end of the span, near the shore abutment, there remains a 10 ft. long horizontal crack running about 4 inches above the steel girder. In the September-October 1980 Report, it was stated that this crack is insignificant and repairs are not required. However, in viewing this crack again, it has enlarged and should be repaired.

The horizontal crack at the south end of the span, on the east fascia beam, having a length of about 15 feet,

was described in the September-October 1980 Report as "excessive", requiring repair. The concrete around this crack has now fallen out. The surface is very irregular and has to be repaired.

The September-October 1980 Inspection Report also stated that the top deck of the Approach Roadway had developed 8 hairline cracks. These 8 hairline cracks are still evident, although as described before, they are self-sealing, and do not require repair.

Pump House: The Pump House slab, as described in the September-October 1980 Inspection Report, is in good condition, including the fascia beams, the curbs, the slab itself. The single transverse crack in this slab is hairline. It is at about the third point of the Span at its north end. No work is required.

Span No. 2 - Topside: Between the Pump House and Dolphin No. 1 - as described in the September-October 1980 Inspection Report, there is a longitudinal crack in the west fascia beam, above the steel girder, that has opened up. It was recommended that the sliver of concrete be removed and replaced with new concrete. The recommendation still applies. In fact, it appears as if this crack had opened up more since the last Inspection Report.

The east fascia beam, as seen topside, appears to be in good condition.

The September-October 1980 Inspection Report mentions 8 transverse hairline cracks. They are still evident - very fine cracks, some difficult to see. No work is necessary, and no additional hairline cracks have developed in the interim.

The railing on the west side of the roadway seems to have been damaged since the September-October 1980 inspection.

The railing is tied down by plates to the curb. Altogether there are 12 vertical pipes holding the railing and of these 12, the 7 tiedown plates at the north end have been bent or ripped off the curb. This is not surprising, as the bolt holding down the plate to the curb is only about a quarter inch in diameter. Some are rather badly rusted, but judging from the way in which the plates are ripped off, there was a physical force which caused this separation, although it did not distort or bend the pipe railing.

Dolphin No. 1 - Topside: The concrete cap is octagonal in shape, constructed over a circular sheet pile cell. The concrete cap and its fascia around all sides, that could be seen from topside, are all in good condition.

On the southwest side, as described in the September-October 1980 Inspection Report, a section of the concrete curb is shattered. The reinforcing steel is exposed and the metal nosing is bent. The concrete alongside, on the fascia, has indications that something struck the concrete fascia, progressing up its full height, striking the nosing, bending the top in toward the center of the dolphin. The condition is the same as reported previously and requires repairs.

Span No. 3 - Topside: South of Dolphin No. 1, towards Dolphin No. 2 - there is still a single transverse hairline crack about 5 feet from the north end. It is the only transverse crack in the span. Repairs are not required.

The September-October 1980 Inspection Report is wrong in that it mentions a 35-foot long crack along the west fascia beam, towards the south portion of the span. Actually, this entire span is 35 feet long and consequently, this crack at the south end of the west fascia beam, above the steel girder, is only about, say 15 feet long, not 35 feet. The crack should be repaired.

The pipe railing is on the west side of the roadway, with the POL pipelines on the east side. The pipe railing is in good condition. However, the northernmost vertical pipe support is bent outward and should be straightened.

Span No. 4 - Topside: In the center, between Dolphin No. 1 and No. 2, new cracking has occurred in the west fascia beam on the north side, above the steel girder. The crack is just beginning, but seems to extend, intermittently, for a distance of about 20 feet on the north side. It should be repaired.

The pipe railing on the west side has altogether bent out, for the entire length, and requires replacement or straightening.

The September-October 1980 Inspection Report is wrong in that it refers to 4 transverse hairline cracks at the north end. Actually, the cracks are at the south end of the roadway. However, in examining them closely, it is not certain that they are actually hairline cracks or that possibly it is poor troweling of the concrete surface of the roadway. Again, no work is necessary.

Span No. 5 - Topside: Located immediately north of Dolphin No. 2 - a new crack has occurred along the concrete east facia, for its full length over the steel girder below. This crack should be repaired.

At the pipe railing on the west side, the two extreme base plates Nos. 1 and 6, counting from the south end, northward, are bent off the anchor bolts.

There was no evidence of transverse cracks in this roadway. The road surface is satisfactory.

Dolphin No. 2 - Topside: The decking of Dolphin No. 2 is in satisfactory condition, without cracks. In the area where the three new tension anchorages were installed, concrete patches were placed in the deck. They are of satisfactory appearance with slight perimeter hairline cracking around each patch.

On the west curb, between the two bollards, there was a steel nosing that had been ripped off. It appears that some repairs were made to the curb in this area, but not neat. Also, the life preserver pipe stanchion, located on the east side of Dolphin No. 2 is bent and should be straightened.

Span No. 6 - Topside: South of Dolphin No. 2 - on the west facia beam, at the north end, about 8 feet of concrete has fallen off, exposing the reinforcing steel on top of the steel girder. This condition is much worse than seen in September-October 1980. In addition, there are a series of intermittent, but full length hairline cracks in this facia above the steel girder. The entire section will have to be probed and quite possibly repaired for the full length of the span, which is about 60 feet.

The east facia beam has some intermittent hairline cracks, about 3 ft. long, at three locations along the length of the beam. These are too small to be repaired at this time, but quite possibly they represent the beginning of progressive deterioration and will require repairs in the future.

The pipe railing on the west side of the Pier is satisfactory, except that the last vertical pipe at the north end should have its base plate twisted into shape to fit the curb more satisfactory. However, this is not essential.

It is noted that the light hoods on the east side of the Pier are damaged. They are white plastic reflectors.

Span No. 7 - Topside: North of the Loading Platform - the east fascia beam has a series of hairline cracks above the longitudinal steel girder. These cracks are about 5 ft. long and are located at about 4 to 5 areas. They should be repaired before developing into a major problem. This work will have to be done beneath the POL piping on the east side of the Pier.

The west curb, at the center of the span, for a length of about 5 feet, shows considerable spalling. As mentioned in the September-October 1980 Inspection Report, it is believed it was damaged by the Contractor.

The pipe railing on the west side, on the south half of the Pier, has been badly damaged and bent completely out of alignment. The southernmost vertical pipe is missing and the base plates are not functioning properly. Altogether, this length of pipe railing had 6 vertical pipes, of which 5 remain. The horizontal piping is very badly misaligned.

A lump sum contract had been signed with DANAC, to accomplish concrete repair work for the Approachway, based on a drawing prepared by the Government, identifying all of the work that was required. This drawing was essentially complete, consistent with the above descriptions, plus the description of work given in the September-October 1980 Report. There were a few minor omissions, which can be included as the work proceeds.



It is understood that this repair work will begin about June 15, 1981 and require about 6 weeks to complete.

Regarding the damaged railing, it appears that this damage was not due to DANAC, but rather by normal Base operations. It is understood that the railing repair work will be contracted out by the Army TTU unit, which will supervise general rehabilitation, including this work.

#### WALKWAY BETWEEN DOLPHINS NOS. 3 AND 4

The walkways, between Dolphin No. 3 and Dolphin No. 4 consist of two spans, with center support provided by a 4-batter pile bent. At the span, affixed to Dolphin No. 3 (the north span), the railing is very badly bent on the west side; whereas on the east side, the railing is bent only near its extreme north end. The remainder of the railing on the east side, for this first span, is relatively straight.

It appears as if this north span, between Dolphin Nos. 3 and 4, was struck on its west side near its south end, where it bears on the 4-pile intermediate bent. The bottom flange has a horizontal kink, as if it were struck by a force traveling from west to east. In addition, the concrete deck planks in this area, where the two spans abut each other over the support, are loose and the railing itself, between the two spans, is displaced in that the northern span railing is displaced towards the east.

Finally, it appears as if the second span (south span) is a couple of inches lower in elevation, where it abuts the north span, over the four-pile bent. The conclusion is that something struck the northern span at its south end, on its west side.

The pipe railing for the second span (south span), from the four pile bent onto Dolphin No. 4, is in good condition and no work is required other than repainting. However, it appears that at the extreme south end of the two spans, where the second span abuts onto Dolphin No. 4, there is another kink in the bottom flange, again as if the spans had been struck by a force traveling from west to east. It is not a sharp-angled kink as the one previously described, but is somewhat bow shaped, about 10 feet long.

DANAC claims that they had not gone near this area with their equipment and that they are not responsible for this bend in the walkway.

It is understood that when the POL Pier was originally built, there was a severe storm and these portions of the walkway had been knocked off their supports into the Harbor. They were subsequently lifted up and put back into position. It was DANAC's theory that the damage occurred during that storm.

The reason for the differences in elevation, between the two walkways at the intermediate bent support, is that the

southern walkway had its grout washed out from beneath its bearing plate support, and it dropped in elevation. This drop in elevation may overstress the pipes that are supported on the walkway, used for fire protection.

The solution is relatively simple - place steel wedges, driving them beneath the bearing plate to lift up, and then drypack grout underneath. The Government will have this repair work done as added work on the DANAC Contract.

#### FENDERS AT DOLPHIN NO. 4

It is understood that tugs berth along the south side of Dolphin No. 4. Apparently, the procedure is to push off the bow of the vessel, towards the west, when the ship departs.

The present fender system consists of old timber piles, which require replacement. It is planned by the Army TTU to drive new piles, and to continue some of the fendering around to the southwest quadrant, possibly to the southeast quadrant, as the tugs tend to rotate around Dolphin No. 4.

It is unfortunate that this work was not originally requested, as it could have been included in the DANAC Contract.

It was stated that there would be a maintenance problem, after installing new timber piles off Dolphin No. 4, similar to the maintenance problem that existed before at the

Loading Platform. It was therefore suggested that all of the timber piles at the south end of Dolphin No. 4 be removed and replaced with Delta fender units, as installed on the other three sides. However, this cannot be done, because during low tide, the tugs are low in the water and could get caught beneath Dolphin No. 4

Another suggestion was to hang an apron down from the south end of Dolphin No. 4, with a series of brackets, braced back to the pipe piles. This is possible, but it would be necessary to direct the reaction from the bracket towards the top of the piles, to prevent local buckling of the pile walls. There is concrete fill in the top sections of the pipe piles, and also less corrosion, than near the waterline.

In summary, nothing was settled with respect to this matter of fendering for the tugs berthing at Dolphin No. 4, other than the general idea that instead of driving timber piles, it may be better to install a timber apron on a bracket system, extending down to Mean Low Water.

#### ELECTRICAL WORK

DANAC stated that installation of the lighting was not yet finished due in part to the fact that they could not connect to the existing system as shown on the plans, because it was not originally installed, as shown. The existing wiring

is different, and consequently, they had to make changes. DANAC had prepared sketches for a new wiring layout. They will proceed with this revised wiring. The electrical engineer will review the wiring diagrams and if there are any comments, DANAC would be contacted.

Some of the circuit breakers were not working and had to be bypassed. This was another reason for changes in the wiring layout. For this reason some of the wiring is exposed on the deck area, but only temporarily.

The explosion proof junction boxes that were specified, were not made up for an internal ground hookup. They would have to drill holes in the explosion proof boxes and this is not permitted by the Code. For example, it was pointed out that light block GUAT-26 does not have a grounding connection. Accordingly, this matter of whether or not junction boxes are to be grounded will be reviewed by the electrical engineer

#### CATHODIC PROTECTION

In discussions with DANAC, it was emphasized that cathodic protection was important. A decision then had to be made whether there was to be full cathodic protection at this time or none at all. This depended on what the Air Force plans to do with the existing Pier. Accordingly, Air Force headquarters in Illinois were contacted and they stated that full cathodic protection should be provided.

Presently, the existing Pier and pipelines do not have operational cathodic protection. However, keeping in mind the proposed expansion at Lajes and the new facilities that are to be constructed, the Army and the Air Force do want full protection.

Accordingly, once the existing old Pier and pipeline are cathodically protected, the new construction must also have cathodic protection, to avoid becoming an anode for the other system, causing accelerated corrosion. It is understood that the Base cathodic engineer will balance the new and old systems.

It was stated that when inspecting underneath the Pier in September-October 1980, many cathodic wires, connecting the piles, had been ripped off. All of this has to be reinstalled so as to have continuity of cathodic protection

It was also pointed out to DANAC that at the light pole, for the South Dolphin, a neoprene jacketed cable came out from beneath the deck, and went into a pipe filled with water. Furthermore, the neoprene jacket was wearing out on the sharp edges of the pipe. There was no reason for this neoprene jacketed cathodic cable to go into a pipe. DANAC will resolve this matter.

The discussions on cathodic protection were concluded with the acknowledgement by all that the new system

must be balanced with the Base System. However, the only responsibility at this time is to install the wiring properly, for continuity.

In this regard, it was pointed out that the channel caps on top of the steel sheet piles, are a part of the cathodic circuit and consequently closure plates must be welded across the 2 inch gaps in the channel caps, as previously described. This would then provide full electric continuity for cathodic protection and also, would eliminate the possibility of a mooring line getting caught in the gap and ripping off the channel.

DANAC stated that they could finish all remaining work on the cathodic protection system in one week.

#### DANAC STORAGE SHED

The DANAC storage shed had been sold to the Government. Apparently, it will be reconstructed into a two-story structure, for use by the TTU staff.

#### CONTRACTOR'S CLAIMS

At the last site inspection, in September-October 1980, DANAC had two claims pending. One was for delays in unloading their crane, and the second was due to the fact that TTU had limited the lift on their crane to 7,500 pounds. Both of these claims have been settled, giving DANAC some time extension and some additional payment.

At present, there are no outstanding claims by DANAC, to be resolved.

#### CONCRETE BLOCK WHARF-CORNER

During the last visit of September-October 1980, there was considerable concern that at the corner of the onshore hardstand, one of the concrete blocks was missing from the wharf face. The area was again inspected and it was found that the block was still missing. There had been concern that a crane standing on top of the wharf could cause damage.

Repairs can be made by installing some timber form work, and pouring concrete. Alternatively, the hole could be filled with small concrete blocks, mortared in place. It is understood that the original large concrete block is somewhere on the beach, and possibly could be retrieved and reset.

No decision was made as to what would be done, and who would make the repairs.

#### FUTURE HARBOR WORKS

It is understood that future dredging of the Harbor will be to Elev. -42 ft. MLW.

Also, it is understood that there are major plans for development of Praia Harbor. This would include new break-water construction, waterfront development, and a commercial harbor. The detailed status of these plans is not known.



## AS BUILT DRAWINGS

As built drawings had not been prepared, prior to this June 1981 inspection visit - although it was understood that such drawings would be ready.

According to DANAC, there were very few changes, from the Contract Drawings, generally summarized as:

1. Light Tower Base Plate - two extra base plates were installed, to accommodate the 10 bolt base plate pattern.
2. Interference with Pipelines - while driving the steel sheeting for the New South Dolphin, an abandoned submarine pipeline was struck at several locations. To install the sheeting, the line was cut or the sheeting was driven through the pipeline.
3. Walers at Loading Platform - relocated to Elev. +10 ft. MLW.

Additional information concerning As Built conditions, obtained from DANAC, includes:

1. Pile Penetrations for Sheet Pile Cells - Reportedly, every steel sheetpile was driven to Elev. -65 ft.
2. Rock Anchors - data was tabulated for each rock anchor, including the length of coring into rock, and the length of casing measured from the top of concrete cap, down to bed rock. It is noted that there are substantial variations in the lengths of casing, within a given dolphin.

Additional information requested, but not yet received, includes - settlement measurements for the sheet pile cells and their fill, concrete compression tests, underwater

inspection reports, concrete core data from crack repairs by epoxy pressure grouting, and pile driving records.

Overall, the impression is that DANAC has not kept detailed records. Perhaps this is a "bookkeeping problem", with the required information included in the daily reports or notes, but not yet compiled.

#### FUTURE INSPECTION VISITS

It is not known whether an additional site inspection will be authorized, since the work is not complete.

Also, a final underwater inspection, by a diver is required.

\* \* \* \* \*

END